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ABSTRACT

The document presents 11 papers dealing with educational administration in developing nations. It is intended to aid UNESCO staff members and other educational advisers as they collaborate with policy makers in developing nations to improve educational programs. Written by staff members of UNESCO's Division of Educational Finance, the papers reflect concerns expressed by educational authorities in developing nations regarding major policies, plans, and priorities for their national systems. The practical problems and theoretical issues were identified by UNESCO staff members during 74 fact-finding missions to developing nations conducted from 1965 to 1975. Sample topics focus on equity in educational planning, agricultural and vocational training, differences between rural and urban education, training centers for rural development, technical training in the Soviet Union, engineering education, rural education in Honduras, teacher training programs, political influences affecting teachers, and veterinary training. For most of the papers, schematic sketches, tables, charts, and graphs are presented along with case studies representing aspects of educational systems in one or several countries. (DB)

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Educational Development -
Some practical issues

Documents prepared by members
of the Division of Educational Financing

Le développement de l'éducation -
Quelques questions d'ordre pratique

Documents établis par des fonctionnaires
de la Division du financement de l'éducation

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INTRODUCTION^{1/}

The papers in this collection deal with a variety of problems and issues that Governments of developing countries are facing in the day-to-day administration of educational services. They are primarily intended for use by Unesco staff, at Headquarters or in the field, who are serving these Governments in one capacity or another. However, certain topics may also be of wider interest.

The collection is not homogeneous. Some of the papers deal with problems that are straightforward and down-to-earth. For example, a Ministry of Education decides that school-teachers should get practical training in handicrafts or elementary science and technology, so they want to include a workshop in new teacher training colleges. But what does such a workshop look like, and how much does it cost? In a number of countries neither the Ministry of Education, nor the Ministry of Public Works, nor local architects know the answer - hence the paper on the design and costing of workshops for teacher training colleges. Other problems are more complex. Thus, the health of animals is of very considerable economic importance in most countries. But the training of veterinarians is extraordinarily expensive - probably the most expensive form of higher education - and poor peasants cannot afford to pay veterinarians anyway. As a result of this dilemma, it often happens that little or nothing is done, even in countries which as a matter of policy give priority to the development of rural areas. The paper on veterinary services and the training of animal health assistants discusses this problem, suggests under what conditions it would seem essential to train animal health personnel, and how they might be trained. Other papers deal with issues that Governments are facing in formulating national educational policies. These include, for example, the equitable distribution of educational services, and the question as to whether a special type of primary education should be provided in rural areas.

These and other questions have cropped up in connection with the work of the Division of Educational Financing over the last three years or so. Within Unesco, the task of the Division is to assist Governments of Member States to formulate requests for financing by IBRD/IDA. To do this, staff from the Division visit Member States for several weeks at a time, gather the basic data on national systems of education, and discuss with the authorities concerned their policies, plans and priorities for the development of their national systems of education.

In the course of this work, a large number of problems are encountered. Some of these are unique, others appear to occur in several countries and these were chosen as topics for the papers in this Report. All the Chapters have been written by staff members of the Division of Educational Financing and they have been edited by W. L. Taylor, also a member of this Division.

^{1/} By Mr. W. Van Vliet, former Director of the Division of Educational Financing.

INTRODUCTION¹

Les articles réunis dans ce recueil traitent de toute une gamme de difficultés et de problèmes auxquels les gouvernements des pays en voie de développement doivent faire face dans l'administration quotidienne de l'enseignement. Ils sont avant tout destinés aux membres du personnel de l'Unesco, au Siège ou hors Siège, qui à un titre ou un autre sont au service de ces gouvernements. Certains thèmes, toutefois, pourraient intéresser un public plus vaste.

Le recueil n'est pas homogène. Certains de ces articles concernent des problèmes simples et concrets. Par exemple, un ministère de l'éducation décide que les instituteurs devraient avoir une formation pratique pour les travaux manuels ou les sciences et la technologie élémentaires, et envisage par conséquent d'inclure des séances d'initiation pratique dans les programmes des nouvelles écoles normales. Mais comment se présente un tel atelier et quel en est le coût ? Dans un certain nombre de pays, ce ne sera ni au ministère de l'éducation, ni à celui des travaux publics, ni chez les architectes locaux que l'on pourra trouver la réponse - d'où l'article consacré aux plans et au coût des ateliers d'école normale. D'autres problèmes sont plus complexes. La santé des animaux, par exemple, revêt une importance économique considérable dans la plupart des pays. Or la formation de vétérinaires est très onéreuse - elle est probablement la forme d'enseignement supérieur la plus coûteuse qui soit - et des paysans pauvres n'ont en tout état de cause pas les moyens de consulter des vétérinaires. Il arrive souvent que l'on ne fasse pas grand-chose, voire rien du tout, pour sortir de cette impasse même dans les pays qui ont pour politique de donner la priorité au développement des régions rurales. L'article sur les services vétérinaires et la formation des auxiliaires de santé vétérinaire est consacré à cette question, et contient des suggestions relatives aux conditions dans lesquelles il pourra sembler primordial de former du personnel de santé vétérinaire, et comment on peut y parvenir. D'autres études sont consacrées aux questions qui se posent aux gouvernements lorsqu'ils leur faut formuler une politique nationale en matière d'éducation. Ils portent notamment sur la répartition équitable des services d'enseignement et sur la question de savoir s'il faut prévoir un type particulier d'instruction primaire pour les zones rurales.

Ces problèmes et d'autres encore se sont posés à propos du travail effectué au sein de la Division du financement de l'éducation depuis trois ans environ. A l'Unesco, la Division a pour mission d'aider les gouvernements des Etats membres à formuler des demandes d'aide financière adressées à la BIRD/IDA. Pour ce faire, les fonctionnaires qui en font partie effectuent dans les Etats membres des séjours de plusieurs semaines pour y rassembler les données de base sur les systèmes d'éducation nationaux, et examiner avec les autorités compétentes les politiques, les plans et les options appliqués au développement de ces systèmes.

L'exécution de ces tâches se heurte à toutes sortes de problèmes. Il en est d'uniques, mais d'autres semblent être communs à plusieurs pays et ce sont eux qui ont été choisis comme sujets des articles réunis dans le présent recueil. Tous ses chapitres ont été rédigés par des fonctionnaires de la Division du financement de l'éducation et mis au point par W.L. Taylor qui appartient également à cette Division.

1. Par M.W. Van Vliet, ancien directeur de la Division du financement de l'éducation.

EQUITY CRITERIA IN EDUCATIONAL PLANNING

by

J.A. Smyth

EQUITY CRITERIA IN EDUCATIONAL PLANNING

The Demise of Efficiency Criteria

In recent years public discussion of the development of educational systems has included an increasing sensitivity to equity criteria in the selection of public policy alternatives. In developed countries, social class and ethnic inequalities in educational opportunities, achievements, and benefits have increasingly dominated debate on policy; in developing countries, rural-urban, and inter-regional inequalities, among others, likewise have been salient. This interest in equity aspects of education has been due partly to heightened political awareness and intensified political pressure by disadvantaged groups, partly to the general cultural assault, particularly in developed countries of the West, on the utilitarian ethic, and partly to a growing public scepticism towards the intellectual coherence of 'efficiency' criteria for investment in education. However, aside from particular causes, there may have been a certain inevitability in the demise of 'efficiency' criteria, for reasons which will be explained.

'Manpower needs for development', which was once the most prominent efficiency criterion, now is widely discredited, not only because so many educational plans based on manpower arithmetic have never been implemented, but also because it is viewed culturally as too primitive a concept, and scientifically as too flimsy. Without an extraordinary bureaucratic apparatus, manpower planning in principle is now seen to be unworkable anyway, and Western proponents of manpower planning unable to reconcile the reality of manpower/educational planning with the theory, have been increasingly drawn to structural and institutional reformism.

Other efficiency criteria have fared no better, even where they have been scientifically more plausible. The 'social rate of return' criterion, for example, has had almost no direct impact on public educational investment policy in either developed or developing countries, and has served mainly as an intellectual focus for scepticism about manpower planning. Unable yet to resolve satisfactorily problems of the quantitative scale of prospective educational investment, which are the salient operational concerns of planning officials, and which have attracted the latter hopefully to manpower planning, devotees of the 'rate of return' criterion have been increasingly drawn to free-market solutions and denial of a role for government altogether. However, like the 'manpower need' criterion, the 'rate of return' criterion is tarred with the same utilitarian brush, and in so far as the application of its logic also implies government activity, for example for the purpose of manipulating social rates of return, it is operationally embroiled with the same problems concerning the role of the State in education, training, and manpower utilization, which bedevil manpower planning.

Current interest in equity aspects of education, therefore, arises against an immediate background of political, cultural and intellectual unease with efficiency criteria in education, in both developed and developing countries. Certain long-standing features of the institutional arrangements for the supply of educational services, in particular the sensitivity of these arrangements to what is broadly known as 'social demand', provide the practical context for this feeling. However, there has not hitherto been much effort by educational planners

systematically to re-appraise either their preoccupation with efficiency criteria or the social, economic and political analysis on which that preoccupation rests.

It is the purpose of this article, therefore (i) to suggest briefly why considerations of distribution probably will always dominate efficiency considerations in the supply of educational services under present arrangements for that supply, and (ii) to discuss briefly some of the more obvious equity criteria and the possibility for consensus as to which, if any, are important. The article should not be interpreted one way or the other as making a plea for equity or efficiency criteria. That distributional considerations will dominate is seen not as something that ought to prevail, but simply as a fact arising from the conditions under which educational systems are presently organized. Much of the analysis depends on a view of what educational planning has actually achieved in various countries in recent years, rather than on what educational planners say they do or are trying to do.

The Role of Government in Education

That the State^{1/} is pre-eminent in education in developed and developing countries, even where it is not pre-eminent in other spheres, is such an obvious universal feature of the institutional arrangements for the supply of educational services that its significance is not often clearly discerned. Indeed, it is frequently neglected even in the analyses of 'radical' educational reformers and 'innovators' - a curious neglect since somebody, or some institution, presumably is to be responsible for educational reform and innovation, even where it has been responsible for the mess to be reformed. That the State, rather than private corporations or individual educational entrepreneurs, dominates, and should continue to dominate, the supply of educational services in most countries, undoubtedly has implications for the range of educational planning policy alternatives. In particular, it implies that distributional or, more loosely, 'political' considerations probably will dominate educational investment policies. But this requires explanation.

Governments, of course, are not like the private corporations of classical or neo-classical economic theory. This is not to propose that they are not bound one way or another by the laws of economics, but is merely to note that their distinctive behaviour in the market should be recognised for what it is, as some complex of economic and political rationality rather different from that of the private corporation. In the market for educational services, the demand can be viewed in standard economic terms as arising from a rational calculus by each consumer or potential consumer of the benefits and costs of purchasing these services, that is, as arising from the structure of private rates of return. In the aggregate, however, this demand does not confront the major supplier, the government, in the same way as it would a private firm: it confronts the government as a political imperative. Thus, educational services, whilst constituting a subset of all services which enter a society's economic behaviour system, also constitute a subset of those services which enter the society's political behaviour system, and in respect to the supply of which at any time there is an interaction between

1/ Understood as a collective term for government authorities.

government and citizenry, of whom consumers and potential consumers of educational services constitute a certain (often privileged) sub-class. In short, the educational consumer has both an economic and a political relationship with the supplier. There is a similar duality in the relationship between the teaching cadre and its employer.

It is, therefore, possibly naive to regard the activities of governments in respect to the supply of educational services mainly in 'efficiency' terms, however desirable it might be that governments should administer educational systems more efficiently. Governments are pre-eminently political bodies. Indeed, it is not at all clear whether 'efficiency' has any more meaning for governments other than as a measure of their legitimacy, which may or may not imply that in some sense they pursue economically efficient policies. In any case, 'economically efficient' educational investment notably is a notion which has been urged on the third world by the main body of development specialists based in the advanced countries of the northern hemisphere. Its status in advanced countries is rather weaker. 'Manpower needs', for example, are things which poor African and Asian countries have, like the 'need' for 'responsible' administration and 'planning' and belt-tightening generally. Questions of citizenship, opportunity, freedom of choice, discrimination, participation and communication, if not regarded as frivolous, are believed to be rather beside the point, which is thought to be 'development'. A healthy utilitarian disdain for these expensive curiosities is thought to be the mark of a vigorous administration: resources are limited, so they have to be optimally harnessed for 'development', the argument runs, otherwise the country will never be 'viable'; and if the supply of educational services is not determined by 'manpower requirements' then resources are mis-allocated and 'development' is retarded.

But ministers of education in poor countries, no more than in rich ones, do not willingly put on hair shirts. And, if after the past decade's exhortations their attitudes towards the manpower plans drawn up for them still remain rather cavalier, if not entirely sceptical, they reflect at least a vigorous appreciation of what government is all about, if not 'development'. Development assistance agencies in the West, such as the World Bank, UNDP, philanthropic foundations and the like, therefore, in so far as they conceive their functions as being to provide aid to education on the basis of efficiency criteria only, are simply trying to square circles. And there exists no serious evidence that they have been successful in the effort. Governments go on doing what they always have done: trying to stay in power. And if that means paying lip-service to efficiency criteria in order to get money and salve the donor's, or creditor's, conscience, then they will formulate the appropriate 'assurances'. What they do with the manpower plans and the like when the money is banked is embarrassingly well-known.

The Consequences of 'Social Demand'

Educational investment planning, it is clear, must be based on a recognition of the nature of the institution which monopolizes the supply of educational services, and the nature of the relationship between that institution and the demand for education. The differential demands for educational services are political imperatives simply because the government is the government. As was indicated earlier, this does not mean there is no rational economic basis for 'social demand'; on the contrary, the structure of private rates of return probably is crucial. But it does mean that because private rates do not necessarily coincide

with social rates of return (which constitute efficiency criteria), the government is politically hamstrung in its pursuit of efficiency objectives. How prepared a government will be to withstand social demand, for the purpose of achieving any particular efficiency objective say, will depend largely on its power relative to the interests involved, and there is, of course, no reason to suppose in any instance that a particular objective will be feasible. Paradoxically then, while to all intents and purposes governments 'control' the supply of educational services, and an astonishingly voluminous literature and a thousand conferences have been based on the assumption that it is a pliable 'instrument' for 'development' in their hands, the reality probably is rather closer to the opposite. Governments, in respect to the development of education, are probably little more than instruments of the social demand for education, and can hardly be otherwise. In this view, there is no surprise at the litter of abandoned manpower plans in the third world and elsewhere, or the frantic visions of an educational 'crisis' among philosophers of 'development'. The fact of the matter may just be that measured by what governments actually do and are able to do in education, not by what their planning officials say they ought to do, efficiency questions, as distinct from questions of distribution, just are not all that important.

However, in so far as the actual development of educational systems has been mainly a response to the structure of private rates of return (i.e. social demand), with the public authorities continuously driven to expand the provision of places in education sectors with high rates and in other sectors providing access, and in so far as the pressure of social demand everywhere is distorted by the differential distribution of political power, the solutions actually reached to the distribution problem vary considerably in the degree to which different social groups participate in them. Since the structure of private rates of return typically is an inverse pyramid with the higher rates corresponding to higher levels of education, mainly because private costs apart from foregone earnings are held down by the tendency of public policy to minimize fees, the general effect of the pressure of social demand has been to cause most public authorities over time to shift more and more resources into the higher levels of education. Of course, this shift is inevitable once complete coverage at the lower levels is attained, but it is a striking phenomenon that throughout the third world, for example, the shift has occurred (and has been vigorously encouraged by external aid) even with significantly less than complete coverage of the lower levels.

The net result has been that at this juncture a great many countries now have large portions of their populations, chiefly the politically weak and excluded, who are without access to any educational services at all. A similar process operates in developed countries, although total exclusion is more rare there.

The operations of the market for educational services, therefore, whilst they ultimately produce a solution to the problem of distribution, produce only a pragmatic solution, not necessarily an equitable one. They do not necessarily produce either a universal minimum provision of educational services, even where this is a feasible budgetary burden, or an equitable distribution of educational opportunity, even where this is taken to mean little more than equi-proportional enrolments by simple social category such as race or socio-economic status. Even less, perhaps, do the operations of the market produce economically efficient solutions, except in terms of the parameters of the market itself as presently constituted. The resolution of the dilemma posed for efficiency by social demand

has been so much dominated by pragmatic considerations of distribution that governments have even been prepared to tolerate high levels of unemployment among educated persons in order to enlarge the pool of access to the educational prerequisites for whatever jobs are available, and in the process have sunk manpower/educational planning without trace.

Measures of Distribution

Present arrangements for the supply of educational services do not necessarily produce either efficient or equitable distributions of these services, but are not easily changed. Indeed, it is not at all clear whether they can be changed in their essential points at all. At least, any change less than that of getting government out of the education business altogether would be rather less than radical, let alone revolutionary. Short of that, it is clear that questions of equity have priority over questions of efficiency, if only because by its very nature the central concern of government in education must be distribution. To strike its own balance between conflicting interests and powers with respect to the present and future essentially is the problem of government, and this is plainly not essentially an efficiency, as distinct from distribution, problem, nor is it essentially a problem of more concern to rich countries than to poor ones.

Yet it is an obvious precondition for the resolution of the differential demands for educational services that there be a consensus on their equitable resolution. This does not necessarily mean that some groups will not be discriminated against one way or the other in the event, but merely that equity is the only area in which a dialogue can occur. The problem of equity, therefore, lies at the heart of the settlement between citizens and State in respect to the supply of educational services. A settlement, 'efficient' or otherwise, in which there is no consensus as to its equity, simply is the rule of force, and is potentially unstable for that reason.

Doubtless, the scope for purely subjective dispute about equity in education is rather large. If there is to be any constructive discussion it will have to focus around objective measures, even though there be room for disagreement as to whether one or another measure is a better indicator of what is equitable. Essentially, there are two sorts of problems in reaching agreement upon an objective measure of equity in the distribution of educational services: the first is whether the equity focus is to be the distribution of educational services per se, rather than the distribution of things outside of but dependent, in varying degree, on education, such as income and wealth, citizenship participation, and so on; and the second is whether the equity focus is to be the concept of a minimum universal provision or some formal characteristic of the distribution itself, such as the mean years of schooling completed, or the coefficient of variation, or whatever. The two sets of problems constitute a useful matrix of measures for further discussion:

	Educational services <u>per se</u>	Education-dependent things like income, citizenship participation, etc.
Minimum Universal Provision	e.g. Universal primary education, or compul- sory schooling 5-15.	e.g. Universal literacy, or income-poverty floor.
Character of the Distribution itself	e.g. Shape of the educational pyramid.	e.g. Coefficient of variation of incomes.

It will be fruitful briefly to consider essential features of some possible measures in each of the four boxes in turn, beginning with the first column.

The Distribution of Educational Services per se

The most common measure of an equitable minimum universal provision of educational services per se is, of course, universal primary education. In wealthy countries universal secondary education is a more usual measure. Universal primary education is disputed by two sorts of 'efficiency' critics: those who regard it under present arrangements as according primacy to schooling, which is considered an inefficient means of imparting whatever it is that is supposed to be imparted by primary education, and those who regard it, more primitively, as focusing on what is thought to be an education with only consumption, as distinct from investment, content. Recently, some critics of primary schooling have promoted the idea that such education is more appropriate for urban than for rural populations in developing countries - non-formal education being appropriate for the latter. Since much of the demand for education by rural populations probably is for an education similar to that provided to urban populations, this criticism raises equity problems of its own, particularly if universal primary education is a feasible burden for the government's budget.

Moving down to the next box, the shape of the educational pyramid is probably the most commonly recognised conceptual characteristic of the distribution of educational services per se. There is much room for dispute, however, as to whether one sort of pyramid is more equitable than another. For example, if the equity focus is access to basic education, a pyramid with a wide base and relatively thin enrolments at higher levels could be regarded as a more equitable distribution of enrolments than a pyramid with a narrow base and relatively wide enrolments at higher levels. If the equity focus is access to post-basic education the latter pyramid might be regarded as a more equitable distribution of enrolments. In general, the equitable character of an educational pyramid is some function of the weights to be attached to the enrolments at the different levels of the pyramid relative to each other. Selection of the weights necessarily must be arbitrary; given equal weights there is probably more consensus in favour of pyramids with relatively wide bases, on the grounds that greater access to basic education is to be preferred in equity to greater access for beneficiaries of basic education to continue to higher levels. The degree to which an educational pyramid is inequitable can be usefully, though arbitrarily, summarized by a single ratio if the unit costs of the different levels of education are taken

into account: the ratio of total actual enrolment in the pyramid to the hypothetical enrolment if all students were given an equal amount of education within the same total budget outlay.

The educational pyramid, however, captures only one equity aspect of the distribution of educational services per se: the relation of enrolment at one educational level to another. But many critics of social inequalities in education are more interested in the equity of access to education, as between social class, race, religion, and so on; equi-proportionally, or 'quota', measures would be their main concern.

The Distribution of Things outside Education

The distribution of income and wealth is, of course, the main focus of most discussion about social justice, and some critics of social inequalities in education are more interested in the things partly dependent on education, like income, wealth, occupation, and so on, than in the distribution of educational services per se. Although it is difficult to draw a hard and fast line, these critics, with their concern for what people can or ought to be able to do with their education, are more inclined to an 'instrumental' view of public policy and education than their colleagues whose focus is mainly on access to education. There is much dispute, however, as to how and in what degree things like income, wealth, and occupation are indeed connected to education, and some grounds for believing that the connection is weaker in developed than in developing countries.

A social problem which is possibly more salient in the latter than in the former is the simple capacity for citizenship, in particular the problem of literacy. If literacy is defined as one of the minimum prerequisites for meaningful citizenship participation, then a provision of appropriate educational services is implied. In recent years Western 'efficiency' critics have vigorously disputed the literacy campaigns of the third world from the standpoint of a doubt about their ultimate 'economic' benefits, particularly if the literacy education has not stressed what are thought to be 'functional' (i.e. economically productive) aspects.

In developed countries, the conception of a social minimum tends to be defined in terms of a floor minimum income, or 'poverty line', and the like; and it used to be argued, though less frequently now, that such 'floors' implied appropriate provision of educational services, on the grounds that the poor in the main could not be expected to lift themselves out of poverty without a basic educational preparation. This view has probably been one of the main rationales behind external aid to education in developing countries in recent years.

If the equity focus on income is not so much social minima but rather the character of the income distribution as a whole, the implications for the provision of educational services are very unclear. Much recent argument, particularly in developed countries, has been concerned to indicate that the connection between education and the distribution of income is 'only' partial, whereas it used to be more commonly argued that the connection was 'significant'. Though this is rather like a dispute as to whether a glass is half empty or half full, the effect will probably be a greater scepticism towards the 'instrumental' view of public policy and education, and more salience for a focus on the distribution of educational

services per se, and, for that matter, more direct means of redistributing income. Such a movement among professionals actually would be little more than an adaptation to the prevailing circumstances of public policy, which in most countries has never seriously attempted to redistribute income through education or even through arrangements, such as fees, for bearing the costs of education.

Equity Criteria in Educational Planning

Since there are a variety of ways of looking at equity in the distribution of educational services, indeed the whole subject is obviously of continuing public concern and, for educational planners full of potentially interesting methodological and technical problems, it is rather surprising that educational planning presently is mainly embroiled just with questions of efficiency. Doubtless, the emphasis on efficiency partly has reflected a bureaucratic inclination, but it has probably reflected also that manipulative view of education which has directed discussion of development and social change, particularly in respect to the third world, in recent decades, and which has its philosophical origins in colonialism. Problems of distribution are of as much concern to governments of developing as of developed countries; indeed, they probably dominate in both. It is inevitable that the solutions will in varying degree be 'inefficient', and it may well be futile in the nature of things - the present arrangements for the supply of educational services - to hope that they will be otherwise. It is certain, however, that educational development plans which do not incorporate proposals for the equitable distribution of educational services, whether it is for common basic minimum provisions, less racial or regional discrimination, fair selection procedures, or whatever, will be entirely irrelevant.

AGRICULTURAL TECHNICIAN TRAINING

by

T. Ramos Saco, R. Aujame, R. Brain and Y. Tencalla

Preface

This paper is intended as a working instrument for members of the Division of Educational Financing in the course of missions organized under the framework of the Cooperative Programme between Unesco and the IERD/IDA. While care has been taken to assure that the opinions stated fall in line with the policies laid down by the Director-General and the General Conference, a certain number of problems are covered on which no Unesco policies have, as yet, been explicitly stated. In such cases the staff of the Division has expressed its own views and although these opinions are, for the most part, based on the current practices of Unesco's programme implementation, they do not necessarily reflect those of the Unesco Secretariat.

AGRICULTURAL TECHNICIAN TRAINING

Introduction

This paper has been drafted in five parts:

- Part I - General Outline
- Part II - Study of Existing Curricula and Course Structures
- Part III - Physical Facilities and Costs
- Part IV - Curricula Construction - an Example
- Part V - Design of Buildings

Part I is based on a general consideration of agricultural technician training including a discussion on course contents, teaching methods, student selection, and staffing, while Part II examines existing training courses and comments on the general patterns found. Part III reviews the physical facilities, buildings and equipment needs, and discusses both capital and recurrent costs. Under Part IV an example is given to illustrate the methodology of relating both teacher requirements and physical facility needs to a type curriculum. Part V examines practical design problems, including farms.

The term "agricultural technician" is applied in this paper to sub-professional level personnel trained in agriculture who, to a large extent, are expected to perform intermediary technical functions between the farmer and the higher level professionals (usually university graduates). The type of occupation performed by agricultural technicians in developing countries is mainly of an advisory or supervisory nature (e.g. as members of agricultural extension services) aimed at improving farming and its related activities. Agricultural technicians are expected to have a sufficient knowledge of the basic sciences and their application to agriculture to be able to understand fully the use of modern technology in farming and related activities. They are also generally expected to have the field experience and skills to enable them to influence farmers to adopt modern farming technology. The training of agricultural technicians is sometimes classified as "intermediate-level agricultural education and training".

Various meanings, however, are applied to the term "agricultural technician". Education authorities tend to base the definition on educational attainments, whereas planning organizations often apply occupational functions as a criterion. It is suggested that an attempt should therefore be made by agricultural educators to establish a common understanding of the term, and, if necessary, clarify its particular definition within a given context.

PART I

GENERAL OUTLINE

Objectives for training are related to the type of functions agricultural technicians are expected to perform. These functions vary from country to country, both vertically (levels) and horizontally (range of activities performed).

Intermediary functions between professionals and farmers are not necessarily performed by only one level of personnel in developing countries. It is common to find two levels (lower and higher), and in some countries even more.

In the agricultural extension services of countries with more than one level, lower-level technicians are usually responsible for providing direct advisory services to small and medium-sized farm holders, whereas higher-level technicians are engaged mostly in the supervision of these functions. When an even larger number of levels are found, delegation of responsibilities acquires a more complex nature and raises the question about the need for such a large number of levels.

The question of the numbers of levels of agricultural technicians required is a difficult one. In some cases the need is apparent for having two levels, but it is often difficult, apart from historical reasons (tradition, civil service structures), to justify the existence of more.

The adoption of a single or two-level system of training for agricultural technicians appears to be dependent on the developmental stage and agricultural strategy of individual countries. For example, in countries where the education system has not developed vertically to a sufficient degree, the level of farmers' education is low (high percentage of illiteracy), and where subsistence agriculture is the rule, it may not be feasible or practical to train a large cadre of higher-level agricultural technicians for advisory functions. However, it is possible with further development in education and agriculture for the lower level to become irrelevant and be discarded. Irrespective of farmers' educational levels, if a concentrated geographical coverage of services, plus a technologically intensive type of agriculture is the chosen strategy, this will entail advisory services of a higher level and only this level of agricultural technicians will be needed.

In many developing countries agricultural technicians usually perform a range of activities much broader than those of an exclusively advisory nature, and this range widens and becomes more specialized as countries advance in their development. The activities may cover areas such as: agricultural support services, field assistance in research, pest control, crop campaigns, marketing, cooperatives, supervised credit, farm management, irrigation and water supply, farm mechanization, forestry, animal health and husbandry, agro-business, food processing, self-farming, farmers' training, community development, state farms and farm settlements. Some of these activities will exist both in the private and public sectors.

Educational values, goals and objectives differ from country to country according to social, political and other realities. Curricula construction for the training of agricultural technicians should take these elements into account, bearing in mind that the training is primarily of the job-oriented type and expected to be utilized in particular sub-professional functions.

It is not, therefore, surprising to find variations in curricula for the training of agricultural technicians in developing countries. The mistake of transplanting curricula from industrialized countries to developing countries should be avoided. This does not mean that developing countries should not profit from the experience of more developed countries.

In view of the need for a firm base on which to build an understanding of the implications of science, social science, and applied science on agricultural techniques, higher-level technician training should normally be founded on a complete general secondary education. In certain cases, however, the higher-level course is a part of a promotion chain within a particular civil service, which may entail either the introduction of a larger proportion of general educational matters in the previous low level course, or adaptations in the higher-level course.

In certain cases, especially where the training courses are given under the direct auspices of an employing Ministry, it is possible to base the curriculum on specific job analyses; in other cases, the demands for the output may be more general and the training institution may have to be more adapted to related educational levels. However, even in this latter case a detailed examination of future probable work patterns is basic for curricula build-up.

Thought should also be given to the question of the need for specialization at the higher level, and also to the grouping at this level of areas, such as forestry, agriculture, animal husbandry, agriculture teacher training, into one institution where certain basic courses, especially in applied sciences, can be taught jointly.

The use of a sandwich-type structure, specialized short courses for topping up on an in-service basis are also possibilities at the higher level, as also are linkages, i.e. between a technical college and agricultural college for higher-level agricultural engineering, teacher training college and agricultural college for agricultural teacher supply.

Course Content

Careful study and methodology should be used in constructing curricula. Areas of study include the determination of the posts to be filled by technicians - job analysis of such posts - knowledge skills, communication skills, practical skills, and behavioural attitudes required to perform the necessary tasks. The methodology should include systems of linkages between subject areas, and the effective integration of practical, theoretical and scientific content. The programme of studies will thus be dependent on the above principles but normally it will contain general (basic sciences), socio-economic and technical subjects.

The exact composition of the content of the programme of studies will also vary with the educational level of the trainees. At the lower level, particularly, a higher content of general studies will be needed if the educational level at this entry is low. At the higher level, if a high level of science education is available in general secondary education, basic sciences, for example, could be eliminated and replaced by applied sciences.

The content of technical subjects normally includes basic studies such as soil science, plant and animal physiology, plant and animal nutrition, ecology, etc., and detailed agricultural studies such as crop husbandry, crop protection, animal husbandry. The depth to which these subjects are covered is indicative of the level, and often forms the main distinction between the curricula of higher and lower technician training.

Communication is an important area for personnel engaged in agricultural extension activities and involves a knowledge and understanding both of rural sociology and also of motivation processes. Courses in the socio-economic areas are therefore vital and should include practical studies.

A basic knowledge of economic principles is also of benefit in explaining the principles of profitability and farm management to farmers. Cooperatives and land reform are other important activities in a developing agriculture and entail an understanding of both social and economic principles.

Leading from the introduction of such subjects as rural sociology and anthropology and basic agricultural economics, other more technical topics such as cooperatives, land reform, farm management and the methodology of agricultural extension, can be introduced. It is important that such technical subjects relate directly to realities and so direct contacts with the local farming population, preferably through work or advisory activities, should be encouraged.

Teaching Methods

An important area of teaching is that of practical instruction. Learning by doing is necessary and this principle should be applied both in the laboratory and on the farm. To ensure effectiveness, practical experiences should be closely related to what is being taught in the classroom and, especially at the lower levels, practical instruction should aim at developing positive work attitudes and the understanding of the problems and difficulties of farming.

Efficient organization of practical work is difficult and needs particular study. The inclusion of teaching facilities within the farm and the adoption of special methodologies such as structured teaching of techniques may be of an advantage (see Part V). Visits and excursions to neighbouring agricultural research institutes, state farms and agricultural industries, can also play an important role, as can work activities, either during term time or vacations, within local communities or agricultural organizations. A project method of teaching can be beneficial at the higher level, based on drawing together the various components of the course, and making use of the techniques learnt to solve or investigate certain agricultural problems or processes.

The institution farm is important and has normally to perform the dual functions of a teaching facility for techniques and work activities, and to be a composite whole for the illustration of farm management skills. This latter function may require that a strong commercial bias be given to the farm activities, which, in turn, must be balanced against instructional demands.

To be useful, textbooks have to be based on the local agricultural features; in practice, this raises difficulties in developing countries. More encouragement should be given to experienced national agriculturists to write up their experiences and knowledge. Mechanisms should also be developed to achieve a constant flow of cheap updated materials to teaching institutions. Regional or exchange projects, for or between countries with similar agricultural and sociological features, could assist in providing sources of cheaper teaching materials including good audio-visual materials. Students should be encouraged to make use of available local materials such as extension bulletins, pamphlets and posters, as well as being instructed in the proper use of a library.

Examinations

The best way to set up evaluation tests or examinations is a much debated subject. The following comments are quoted from discussions at the World Conference on Agricultural Education, Copenhagen:

"The value of continuous course assessment and observation of students' progress is a better method of student assessment; the continuous course assessment also allows not only for assessment of the student but also for the course itself. Written examinations test primarily the student's competence in writing but do not necessarily assess the more important applied aspects of the student's ability. It was agreed that tests and examinations should be regarded as being part of the teaching process, but where continuous course assessment methods were used care must be taken in the mathematical computation of the results. It was noted that inadequate assessment can lead to waste of human resources and that the conventional requirements of yearly or written examinations may result in bias against students with practical ability who are well suited for field work."

This underlines the importance of assessing practical abilities and aptitudes in addition to theoretical knowledge. Indeed, in lower-level courses practical ability should be given at least equal weighting with theoretical knowledge when assessing student performance.

Staff

Teachers in agricultural technician training courses must be competent in both the theoretical and practical aspects of their subjects. Because of the nature of the course, the latter should be emphasized. The teacher must also be able to communicate clearly with students and inspire enthusiasm and a sense of vocation.

The main types of teachers are as follows: firstly, those whose training is basically agricultural; secondly, general education teachers, among whom there are those who usually give courses in the supporting sciences; and, thirdly, those who teach socio-economic subjects.

In developing countries, agricultural teachers are often either newly qualified agricultural teachers without field experience, agricultural professionals without pedagogical training, or new diplomates in agriculture with neither field experience nor pedagogical training. Thought should, therefore, be given to ways of upgrading teachers as in-service training courses in pedagogy are often required.

Lack of incentives for promotion and inadequate salaries are the two common negative factors most often found in developing countries when recruiting qualified teachers. Schools of agriculture often become "dumping grounds" for unwanted staff from divisions of the Ministry; this practice should obviously be avoided.

A large core of staff should be employed on a full-time basis. This is the only way in which staff can fulfil their teaching duties adequately, including vocational guidance under a possible tutorship system, as well as others that the institution might require them to perform. All staff for technician training courses, particularly at the lower level, should not necessarily be trained at university level; the calibre and experience of individuals may take preference over academic qualifications.

There is a need for teachers to have an awareness of the content of all courses given at the school, and regular meetings between teachers should be held at fairly short intervals. A teacher responsible for a given subject should be involved in all aspects related to his subject, including practical work in the laboratory and/or in the field. Teachers should be given the opportunity to upgrade their knowledge and widen their experiences.

Special attention should be given to the pupil/teacher ratio as this has a bearing on the quality of the course and on recurrent costs. The ratio is generally expected to be lower in agricultural schools than in secondary general schools. There are several reasons for this, as for example:

- (i) Agricultural teachers normally devote fewer contact hours to teaching because they are expected to be directly involved in the planning, preparation and supervision of students' field work and in the coordination of the education programme with farm activities.
- (ii) A certain number of agricultural teachers would be expected to be engaged in extra-curricula activities related to the role of the school in relation to other programmes.
- (iii) Effective field practice requires the division of the class into small groups.

In a lower-level agricultural technician course, the average number of contact hours should usually be no higher than 20 per week, which requires a large number of staff. In summary, the pupil/teacher ratio would be influenced by factors such as class size, number of teacher contact hours per week and proportion of practical work in the curricula, and the number of groups into which classes are divided for practical work. Examples of pupil/teacher ratio and weekly teaching load for lower-level agricultural technician courses in several countries are given in Annex 1, and an example for the calculation of this ratio is based on a given curricula, class size and number of class groups, in Part IV.

The pupil/teacher ratio in higher-level agricultural technician training courses should normally be lower than that for courses at lower level. The main reasons for this difference are as follows:

- (i) The weekly teaching load would normally be lower because (a) the greater depth to which the subjects are treated would limit the range of subject area covered by one teacher, and (b) some of the teachers are expected to be engaged, to some degree, in experimental work.

- (ii) Class size is usually smaller and students are often divided into smaller groups for practical work.
- (iii) Involvement of the institution in programmes for agricultural development is usually greater, which weights the staff workload^{1/}.

To examine more carefully the influence of several factors on the pupil/teacher ratio, refer to the examples given in Table 6.

Students

Selection procedures for entry to agricultural technician training courses often receive inadequate attention, generating both drop-outs during the course and later in field work.

There are a few countries, however, where elaborate selection procedures have been put into effect. In one of them, as a first stage, the procedure includes advertising information on the characteristics of the institution and employment prospects for school leavers, which is further elaborated during agricultural school staff visits and talks to students of general secondary schools enrolled in the grade preceding admission to the agricultural school. Following a system by which questionnaires are distributed among potential candidates and progressive screenings carried out on them, the final selection of candidates is based on scholastic records, tests, study of the candidate's social background and personal interviews.

In the less-developed countries the supply of candidates of rural origin is often very small because of inadequate extension of secondary general education in those areas. The majority of candidates admitted to courses are from urban areas, and these are either second-rate students who have failed to enter other studies of their preference, having little inclination for rural life and work in an environment foreign to them, or they are students who take the course only as a stepping stone to further studies, or to obtain positions as white collar workers in the central administration. The problem, then, is to find an adequate number of able persons with the determination and interest to perform a function which is oriented towards the rural community and its problems.

Recommendations are often made to developing countries that candidates for admission to the course should be required to have farming practice, as this is often a requisite in developed countries. This recommendation should be examined with caution because farm practice does not usually have the same meaning in developing countries, and even in many developed countries the quality of the "practical" training received by students on commercial farms is being questioned: the type and effectiveness of training depends very largely on the size, range and efficiency of the enterprise, as well as on the ability of individual farmers to transmit their knowledge and skills.

The farmer in developed countries has usually reached a reasonable level of education, fully utilizes mass media information and applies to the farm (which is normally of an economic size) a relatively large amount of inputs and

^{1/} However, as stated in Part IV, this workload is not directly related to the technician training programme.

technology. This, in itself, provides the candidates with a suitable educational environment from which to profit on entering the agricultural education institution.

The picture in developing countries can be quite different. Because of the sharp demarcation found in rural society, a landlord, on the one hand, would not be likely to send his child to a vocational agriculture school but, instead, to a university in or outside the country; on the other hand, although a subsistence farmer would certainly hope that his child can become a government employee, because of the farmer's illiterate or semi-literate status, the uneconomic size of the holding he operates and the primitive farming techniques he applies, the value of farm practice would not be of much significance. Perhaps farm practice at other better private or government farms is an alternative, but the access of peasant farmers' children to them would not be easy and, in any case, the real value of such practices should be carefully scrutinized. To secure the largest proportion of candidates of rural origin is perhaps, in many cases, the furthest one can go in selecting candidates as a means to ensure better equipped products for understanding rural life and the problems that it poses to the community. The introduction of agriculture as a subject in secondary schools can also assist in selection of candidates, as can the use of informal courses and young farmers' clubs.

Relationships between staff and students should be kept as close as possible. Because of the nature of the course, orientation and guidance by the staff become an essential feature. The school should also keep close contact with potential employers. There are a few excellent examples of this in some developing countries where evaluation of graduates' job performance is well organized, based on the opinions of employers, and these are seriously considered by the school in order to detect weaknesses in the education programme, and their rectification.

The Role of the Agricultural Education Institution in Relation to Other Rural Development Programmes

Middle-level agricultural education institutions should be viewed not only as suppliers of agricultural technicians, but also as instruments for change in the rural community. They should participate or coordinate their activities very closely with other programmes for rural development. This plural function could, in turn, benefit the education programme and it would also permit a more effective utilization of existing school facilities (which are expensive) for other development programmes.

The following may be taken as examples of the activities of an agricultural education institution:

- (i) Organization by, or participation of the institution's staff in refresher, vacation, and in-service courses and practices.
- (ii) Operation by the institution of, or participation with other government agencies, in training programmes for farmers and rural youth programmes.

- (iii) Participation in community development programmes.
- (iv) Provision of certain types of services which would benefit the neighbouring rural community and the education programme, e.g. soil testing, poultry vaccination, extension programmes carried out on restricted community areas with the direct participation of students under the supervision of their subject matter teacher.
- (v) Cooperation of the education institution with the extension services, perhaps by utilizing the school as a base. This could also be applied for agricultural research (seed testing, for example), or social service research on the neighbouring community.
- (vi) Establishing formal and informal contacts with other agricultural education institutions and with the various ministries associated with agricultural development in their related organizations.
- (vii) Use of school facilities for evening courses of a varied nature, e.g. functional literacy, family planning and nutrition.

PART II

STUDY OF EXISTING CURRICULA AND COURSE STRUCTURES

To illustrate and detail the particular problems of course structures and curricula, studies have been made of existing institutions over a wide range of countries.

Because general educational systems vary considerably from one country to another the intake levels of the agricultural training courses are directly affected; this in turn affects the length of the courses, and it is, thus, difficult to define absolutely the differentiation between a lower or a higher training level across countries or country groupings.

To facilitate classification within the survey an arbitrary definition has, therefore, been used, based on the total number of school years including the course itself.

Lower-Technician Level	Total Length	12 years maximum
Higher-Technician Level (Sub-university degree)	Total Length	13 years maximum

In a large number of the countries under examination the two types of course co-exist and their purpose is much in line with those outlined above. However, in some developed countries the lower level is sometimes an exception in that it is oriented more towards the training of actual farmers.

Lower-Level Agricultural Technicians

Annex 1 contains information from twenty-one different countries at various development stages, and from various continents of the world.

- (ii) If long agricultural courses are adopted (5-6 years), then, to avoid the above-mentioned obstacles the courses will have a large content of general education subjects which could have been taken, at a lower cost, in a general non-residential school prior to admission to the agricultural course. As a result, the agricultural course (usually residential) will probably be unnecessarily long and costly, e.g. Ecuador, Peru, Poland. Perhaps a course of this nature might be justified by a very limited extension of post-primary education in certain rural areas in countries where it might be necessary to recruit and channel primary school leavers from these areas to the agricultural course. However, the course should be switched to a higher intake level and a shorter duration as soon as conditions permit.
- (iii) In addition, an early intake has the disadvantage of obliging students to make a decision on their future careers at too early an age (12-13 years). If a later age is set for admission, however, the danger arises of not securing the most promising students.
- (iv) Even in agricultural schools where courses cover the later years of a twelve-year education system, students who complete the course would be only 18-19 years old. The problem is greater in countries with a shorter formal system of education (10 or 11 years) as, here, the age at completion of the course will only be about 16-17 years - such technicians may be too young to be acceptable to farmers.

Thus, the following generalized conclusions can be formulated:

- (i) A minimum background of general education of 8 or 9 years (preferably 9) should be adopted for students entering lower-level agricultural technician training.
- (ii) Agricultural courses included in the education system should be initiated as late as possible in secondary education, whenever availability of candidates does not pose a problem. The advantage is that students would profit from a better general educational background when they enter the course. It would also postpone to a more mature age the student's decision to follow agriculture as a career. The length of the agricultural training course should also be reduced as far as possible, to reduce the cost which is, because of its usually residential nature, expensive.
- (iii) Courses with the dual objective of training lower agricultural technicians and simultaneously preparing students for admission to higher education, may result in the non-fulfilment of either objective by failing to meet expected middle-level manpower targets and unnecessarily increasing the costs of the training. Perhaps the alternative of arranging special courses in general education for promising agricultural school products to prepare them for higher education admission, is a better and less costly alternative.

- (iv) In countries with a short formal system of education, the young age of agricultural school products may pose a problem because of immaturity for employment, particularly if they are expected to perform advisory functions immediately after graduation. In this case, either the vocational course would need to be completed after a longer period in the formal system, or an in-service training period after graduation will be required.

Careful consideration should be taken before adopting a particular scheme for the training of lower-level agricultural technicians. Difficulties arise when a scheme has to conform to the overall formal education system. Moving the scheme totally, or in part, outside the formal system is not always an easy task to achieve. Education authorities often tend to avoid the introduction of schemes that would alter the normal pattern of the education system, and have the tendency to value a given scheme by its level of education measured against the formal pattern, instead of taking into consideration the occupational objectives of the scheme. There is also the problem of civil service regulations which determine the salary scale of public employees. If a scheme is outside the formal system of education its level of education may not be clearly visible, and products risk being under-graded.

In Part IV an example is given of the methodology that could be followed in constructing a curriculum for a lower-level agricultural technician course at upper-secondary level, after nine years of general education. The curriculum resulting from this exercise is by no means intended to be considered as a model type of curricula - in fact, it is more of the classical type. The intention is solely to show the various steps or phases that are necessary to arrive at a given curriculum and the methods that could be utilized to calculate the required number and types of teachers, and main building facilities - classrooms, laboratories and workshops.

Higher-Level Agricultural Technicians

The general principles for curricula construction indicated above also apply to higher-level technician training courses in agriculture.

The emphasis on practical knowledge, particularly through field work, should be reflected in curricula and should clearly demonstrate the distinction in objectives between a course of this nature and a degree course.

Annex 2 illustrates the main characteristics of course structure and curricula in higher-level agricultural technician courses for fourteen countries, at various stages of development in several regions of the world. - An examination of this Annex shows that:

- (1) In countries where the general education level for admission to the course is low (less than 11 years), the length of the course is longer (4-5 years) than in countries with a higher intake level, where the agricultural course is shorter (2-3 years).
- (11) The percentage of general subjects in the course is markedly higher in countries where the intake level is low. The agricultural course has then to make provision for deficiencies in

general education because of low educational levels at admission. As discussed for the lower-level course, long agricultural courses make costs higher, particularly when they are residential as in the case of the Ivory Coast, Senegal and Italy.

- (iii) Although there is a wide range of overall variation in the total number of hours devoted to the agricultural course, the average number of teachers' hours does not show extreme variation, being, in most countries, between 1,500 and 2,500 hours..
- (iv) The average percentage for practical work in technical subjects is, for all countries, about 50 per cent, with the exception of the group of countries with higher intake level (12 years) and normally shorter agricultural courses (2-3 years), where the average figure is 32 per cent.
- (v) The total time devoted to socio-economic subjects in the agricultural course, shown in Annex 2, ranges from between 200 and 350 hours in about 80 per cent of the cases.

Because of the higher intake level required for admission to the agricultural course, and the total length of studies required for graduation, the problems of lower-level courses as regards age, immaturity, too early choice of an agricultural career, and employment suitability are not normally found in higher-level courses. However, when intake is at a low level for the higher agricultural courses, the same problem of higher costs also applies.

PART III

PHYSICAL FACILITIES AND COSTS

The physical facilities required for the efficient operation of a course depend on the type of curriculum and extra-curricula activities the institution performs. Broadly speaking, such facilities include: buildings, agricultural land, furniture and equipment

Buildings and Agricultural Land

According to their basic functions, buildings include the following main groups:

- (i) Teaching and communal;
- (ii) Boarding accommodation;
- (iii) Staff housing.

Buildings for teaching and communal activities include: classrooms, laboratories, workshops, farm facilities, library, administration and ablution areas. Previous experience from various developing countries show that the area per student place required would be approximately as follows:

(a) Lower-Level Technician Courses (upper-secondary level)

	<u>Sq.M.</u>	<u>Sq.Ft.</u>
(1) Teaching and communal	8-10	85-110
(11) Boarding accommodation:		
Dormitories (double bunks)		
per boarder	4.5-5.5	48-58
Dining and kitchen area		
per diner (2 shifts)	0.9-1.1	9.6-16
Recreation area	0.6	6.4
(111) Staff housing: number and size of houses depend on local systems applied. However, as examples, the following areas have been applied:		
Houses for senior staff (married)	130-150	1,380-1,590
Houses for junior staff (married)	110-130	1,170-1,380
Houses for administrative staff (married)	110-130	1,170-1,380
Flat for unmarried staff	60-80	640-850
House/flat for auxiliary staff	50-70	530-740
(iv) Farm buildings: facilities are subject to great variations depending on local conditions. A breakdown of unit areas for various farming activities is included as Annex 3.		

(b) Higher-Level Technician Courses (post-secondary)

The only information available refers to boarding accommodation which is as follows:

	<u>Sq.M.</u>	<u>Sq.Ft.</u>
Hostel - study/bedroom (single bunk)	8-9	85-95
Hostel - study/bedroom (double bunk)	6-7	64-74

The school farm is one of the basic facilities of agricultural education institutions, but no set rules can be established because of variations in local conditions and the type of curriculum operated. Land availability and cost may be limiting factors as regards size in some developing countries, e.g. Taiwan, where schools have only a few acres. In this case, arrangements should be made for a more extensive programme of student visits to private farms. On the other hand, this is not the case in developing countries with a more extensive type of agriculture, e.g. Paraguay, where a school owns about three thousand hectares. Intensive or extensive types of agriculture then play an important role with respect to farm size. Construction facilities are influenced not only by these factors but also by the type of husbandry - crop or animal - that prevails in

the country or regions. For example, winery facilities are a particular characteristic in schools located in certain areas of Chile; dairy facilities might be predominant in some countries or regions, while beef might be in others; in some countries, agricultural machinery facilities might be supplied by a neighbouring agricultural station. The criteria to be applied will thus depend strictly on local conditions and the list given in Annex 3 should be viewed only as a guideline. It should be utilized with reservations in relation not only to the components listed, but also as regards the space areas given for the various facilities. Although farm school buildings should be modern in design and should contain some modifications to facilitate teaching, the construction type should remain within the farmer's possibilities. A larger area of land is normally required for higher-level technician training courses.

Most developing countries provide for residential facilities in agricultural education institutions - in some institutions all the students are resident, while in others only a partial number of the students are accommodated. This is not the case in a few densely populated countries where schools operate with only day students. Although, broadly speaking, institutions with residential facilities may offer some positive advantages for the learning process, high costs are a disadvantage. The possibilities of institutions operating with day students appear rather limited in developing countries because of the existence of factors such as the following: the inability of the education system in the rural sector to provide the number of day students in the region where the school is located; lack of transportation facilities between the school and the catchment area of students; government policies for providing access opportunities to the schools to rural students from less developed areas, where vocational agriculture schools do not exist; the need to locate agricultural schools in promising agricultural areas which are somewhat isolated.

The possibilities for agricultural education institutions to operate with day students are greater in densely populated countries with a relatively well-extended education system in the rural sector, and where the transportation system is reasonably developed, e.g. Taiwan and South Korea. It should be noted, however, that these two advantages would be difficult to find in the majority of the less-developed countries.

Provision for staff housing for all or part of the teaching staff and other school staff is also common in developing countries. The main reasons are: living accommodation for the school staff might not be available within a reasonable distance from the school; existing government policies may establish provision of staff housing for institutions at certain levels and of certain types, such as agriculture schools; staff housing can be considered as an economic incentive or fringe benefit for attracting agricultural teachers who otherwise would be difficult to secure. It should be pointed out that because of the nature of courses, school staff housing for some key staff members offer advantages for the education programme and for the administration of the school. Housing may also be essential for farm staff and labour.

Furniture

Furniture requirements depend on the types of construction facilities and equipment utilized.

Equipment

Instructional equipment required by agricultural education institutions may show a wide range of variation, particularly of farm equipment. Local conditions greatly influence the type and number of school farm facilities, and this, of course, is reflected in the type and amount of farm instructional equipment required. No set rules can then be applied to farm equipment needs for agricultural schools. Possibly less variation exists in the need for other types of instructional equipment, e.g. laboratory equipment for general agricultural sciences, including biology, physics and chemistry. Local characteristics and curriculum may, however, have some bearing on detailed equipment needs, e.g. if the school were to put more emphasis on a given sector of agriculture, such as agricultural engineering or animal husbandry.

Perhaps the best guide in selecting the type of equipment required by a given school is to consult some equipment guide lists and apply judgement after studying the school size and curricula. In this respect, it would be useful to consult the basic equipment list for secondary agricultural schools by the International Bank for Reconstruction and Development in February, 1971, and the "Standard Facilities and Equipment for Agricultural Upper-Secondary Schools in Japan", published by the Japanese National Commission for Unesco in 1969. Higher-level technician training courses are normally more demanding for equipment.

Capital Costs

Capital costs are subject to variation according to the size and type of instructional facilities required to implement curricula and to other types of facilities such as boarding and staff housing. For a rough estimate of building costs, the areas given above would be useful if the unitary cost of construction (square metre or feet) is known. Furniture (movable) can be based on a percentage of the total building cost which varies according to the type and level of unit. Built-in furniture is usually included in the building contract. For teaching and communal facilities, the cost of movable furniture may be between 8 to 10 per cent of building costs, and for boarding about 15 per cent. Equipment costs for lower-level courses can be calculated by following the procedures described above where equipment lists are discussed.

The following are examples of actual capital cost per student for fully residential agricultural education institutions:

COST PER STUDENT PLACE - SOME EXAMPLES

(In US.\$)

Country	School Capacity	Course Level	Teaching and Communal			Boarding
			Equipment	Construct- ion and Furniture	Total	
<u>Lower-Level (Upper-Secondary)</u>						
Malaysia	300	10-12	250	570	820	440
Chile	406	9-12	250	680	930	700
Iran	480	9-11	220	600	820	700 ^{1/}
Brazil	500	9-11	360	700	1,080	400 ^{2/}
<u>Higher Level (Post-Secondary)</u>						
Chad	120	11-13	653	1,794	2,447	1,170
Ivory Coast ^{3/}	280	14-15	798	857	1,655	1,250

^{1/} Single bunk.

^{2/} Double bunk.

^{3/} 250 boarding students.

Recurrent Costs

A careful study of per student recurrent costs is very important before agricultural schools are put into operation. Recurrent costs are the largest proportion of overall per student costs.

Costs are subject to great variations in developing countries. Taking U.S. dollar costs as the basis for comparison is not of much relevance as the dollar's purchasing power of services and materials varies widely from country to country. It is perhaps more realistic, for instance, to compare recurrent costs per student between general secondary and secondary agricultural schools. Annexes 1 and 2 show the recurrent costs per student in U.S. dollars in a number of countries, both for general secondary schools and for lower-level (Annex 1) and higher-level (Annex 2) agricultural courses. However, in comparing costs for lower-level courses in African countries, e.g. Ivory Coast, Niger, and Senegal, notice should be taken that these costs apply to agricultural schools which are fully residential, while general schools are only partly residential and in a non-defined proportion. In the case of Korea (South), both types of schools are non-residential, and in the case of Latin American countries, e.g. Peru, Chile, Guatemala and El Salvador, and other countries, e.g. Iran, Jordan and Malaysia, general secondary schools are day schools while agricultural schools are fully

residential. In the first case, the cost per student in agricultural schools is on average 2.7 times higher than that of a general school; in the second case, 0.5 times higher; and 7.6 times higher in the third case. Higher costs in agricultural schools arise mainly because of their residential nature. Costs are also higher because of the very nature of the education programme.

Teachers' salaries and the efficiency of teacher utilization are other major elements influencing recurrent costs. Civil service regulations usually establish teachers' salaries, and it would be unwise to project lower recurrent costs on the basis of a lowering of teachers' salaries (which are already low). In fact, the usual case in developing countries is to find incentives outside civil service regulations to ensure high quality agricultural teachers. It should also be noticed that when schools are too small in size, e.g. 120 students in a three-year course, the problem may be not only the high capital cost per student, but higher recurrent costs as well. As shown later with schools of such a small size, if a reasonably efficient utilization of teachers is expected (e.g. 20 hours per week as a teaching load), it is not likely that the relatively small number of full-time staff required will be able to teach all subject areas included in the curriculum, and, therefore, additional teachers will be needed. If they were on full-time appointments, the recurrent costs per student would be increased because of lower teacher utilization. A possible solution would be to secure additional teachers employed on a part-time basis, but this may not always be feasible in developing countries because of the location of the school. When this is not the case, care should be taken in selecting part-time personnel for teaching duties, as they are usually untrained for teaching, and there will be the danger that the role of the institution in agricultural development may become less effective. This is common in several Latin American countries where a large proportion of the teaching staff is employed on a part-time basis. Intensive student practice under close supervision is essential for an effective education programme, and, therefore, pupil/teacher ratios in agricultural schools are normally expected to be smaller than those in general education schools of similar level, thus leading to higher per student recurrent costs. Lower pupil/teacher ratios would lead to higher recurrent costs per student and there are several factors influencing this ratio that should be kept in mind (see Part IV, Table 6).

Higher costs in agricultural schools also arise because the school farm requires personnel for operational purposes, as well as because of farm operating costs. These items again increase recurrent costs in relation to other types of education.

Although from a purely economic point of view, per student recurrent costs should normally be smaller in large-size schools because of a wider distribution of overhead costs, care should be taken to avoid schools that are too large as this may pose serious administrative problems, as well as problems in providing the individual attention to students that programmes of this type demand.

In respect of recurrent cost per graduate, the shorter the agricultural course, the lower the cost (see Annex 4). The difference in cost per graduate would be greater if the residential course could be reduced to the minimum possible. As the general education background required to initiate agricultural courses does not necessarily have to be taken under residential conditions, it would then be

better, from an economic point of view, for students to enter the agricultural course once they have covered (in a non-residential general school) as much background general education as possible, thus permitting the agricultural course to be shorter, and the cost per graduate less. From a purely educational point of view, this has major advantages, as well as from the viewpoint of the age at which students must make the decision to take agriculture as a career. Annex 4 gives an example in the case of Peru, of how costs per graduate could be reduced under different alternatives.

The point is to find the minimum length desirable for the agricultural course. It does not appear possible to have a set rule on this matter for all countries, because it depends on the general education background of the student when he enters the agricultural course - the objectives and scope of the course (job analysis and whether terminal or non-terminal), and arrangements for field work (in-service training and farming practice out-of-school).

From what is shown in Annexes 1 and 2, it appears that the length of the course can hardly be shorter than two years and perhaps should not be longer than four years. The longer length would be mainly for lower-level courses with still quite a substantial amount of general education which the student was unable to cover in general education schools, or, if as happens in some countries, the course was geared towards higher education admission.

PART IV

CURRICULA CONSTRUCTION AND THE DETERMINATION OF THE NUMBER AND TYPES OF TEACHERS AND BUILDING FACILITIES REQUIRED - AN EXAMPLE

Curricula Construction

The following example of the methodology for constructing a curriculum for a lower-level technician training course in agriculture has been prepared as an aid to the formulation of projects and agricultural instruction development. It should be noted that the pattern on which the curriculum has been built up is purely arbitrary, and is used solely as a framework for demonstrating the methodology.

Once the values and objectives of the educational goals have been established, the next step is to translate them into educational terms. In so doing, it will be noticed that the subjects chosen for the curricula will normally fall within the three main areas: general education (including basic sciences), technical education (agriculture), and socio-economic education.

The various kinds of general subjects, their content and time allocation will depend on the following factors: (i) the general education background required from candidates entering the course (intake level and corresponding curricula); (ii) objectives of the course (e.g. terminal or non-terminal). The approach is to determine the various general subjects to be included in the curriculum, and the time allocation for each, both for lectures and practical work. Careful assessment should be made of the content of the necessary basic science subjects, as these are the essential foundations on which technical courses in agriculture are based.

The various kinds of agricultural subjects and their content will receive special attention. Here the point on job analysis is important if the education programme is expected to be externally efficient. An important decision to be taken is the degree to which specialized skills should be taught, and whether taught at the school or 'on-the-job'. This decision would, of course, depend on the particular arrangements that could be made in the country concerned. The teaching of special skills needed by only a small proportion of graduates should be avoided, and should rather be learnt 'on-the-job', if these skills require expensive facilities. It should be noticed that an excessive breakdown of the courses in special subject areas may result in loss of unity in the teaching, in difficulties in the staffing of such subjects, and in the need for more elaborate physical facilities, resulting in an unnecessary increase in capital and recurrent costs. The study of the agricultural area should result in identification of the various kinds of subjects to be included in the curricula, and the time allocation for each - lectures and practice of various types. This is essential to arrive at the kind of physical facilities and number and types of staff required. Finally, the types of subjects in the socio-economic area and their time allocation should also be established.

Assuming that all the factors referred to above are available, i.e. list of subjects in the three areas, total time of periods required for each (round figures), and their breakdown as regards theory, laboratory, workshop and field, a sequence such as that shown in Table 1 is found. This is based on a hypothetical, classical case and is presented only for methodological purposes and not as a model curricula. The number of periods required for the full course would be 3,456, or a three-year course with an average of 1,152 periods per year.

If it is assumed that the school year is composed of 36 teaching weeks, an even distribution of the course for the three grades would represent a curricula for each grade of 32 periods per week.

The next step is to distribute the various subjects on a weekly basis for a yearly course or a semester course, with care being taken to arrange courses in adequate sequence, (e.g. basic science courses as regards technical courses). The semester system has the advantage over the yearly system of providing more flexibility in this respect. It is the one adopted in the example (Table 2) as it is slightly more difficult for the calculation of staff and facilities. The weekly number of periods for the various courses is shown in Table 1.

Determination of the Teaching Load

From Table 2, the teaching load can be worked out to determine the number and types of teachers required for the course and, eventually, the recurrent salary costs. It will also be used to determine the type of facilities required and, therefore, the capital cost.

Table 3 shows the teaching load related to the curricula of Table 2, which assumes a school with a three-year agricultural course, and three streams of 40 students each per grade (120 students), and with a total capacity of 360 students. Figures in parentheses refer to the number of teaching sessions required, assuming that the class is divided into two groups of 20 students each for practical work.

It will be noticed from Table 3 that the total number of weekly sessions (total teaching load) for those semesters operating simultaneously 1st, 3rd, 5th, and 2nd, 4th, 6th, are 441 and 459 respectively.

Determination of the Number and Types of Teachers

To determine the number and types of teachers required, the teaching load of Table 3 should be examined. If we assume an average teaching load per teacher of 24 periods^{1/} (50 minutes each) per week - equivalent to 20 hours - the number of teachers required for each subject is as shown in Table 4. It will be noticed that teachers of mathematics (Type A) and physics (Type B) teach their subjects only during the first cycle, and therefore, it would not be justified to employ them on a full-time basis but rather, as part-time teachers. The same principle applies to agricultural extension (Type L) and rural sociology (Type M) teachers, who would be teaching only during the second cycle of the school year. With reference to teachers of crop production (Type F), animal husbandry (Type G), plant protection (Type I), and food technology (Type K), the requirements are not even for both cycles of the year, therefore the additional number of teachers for the cycle which is higher could be employed on a part-time basis. However, before making a final decision on the type of employment of the various teachers, an attempt should be made, firstly, to reach a balance between both cycles of the course in those subjects where the demand for teachers is uneven, e.g. three teachers in each cycle instead of four in the first and two in the second; and, secondly, to know what activities some of the teachers will be engaged in, in addition to teaching (see section on "The Role of the Agricultural Education Institution in Relation to Other Rural Development Programmes"). The corresponding load for non-teaching activities should be charged to the corresponding teachers. From a purely educational cost angle, such a load should not be charged to the education programme when calculating the pupil/teacher ratio.

An examination of Table 3 shows that for the first cycle, 21 teachers (18 full-time and 3 part-time) will be required, and 22 teachers (19 full-time and 3 part-time) for the second cycle. However, when the final needs are calculated, after coordinating needs for both cycles, as shown in Table 4, the requirements would be 27 teachers - 16 full-time and 11 part-time (roughly equivalent to 5 full-time teachers), amounting to an overall need of 21 teachers (full-time equivalent). The pupil/teacher ratio would then be 17.1:1.

It should be noted that agricultural schools might often be isolated and part-time teachers for the various subjects might not be available - perhaps with the exception of the agricultural extension teacher who could advantageously be obtained from the extension services of the Ministry of Agriculture. In such a case, it may be necessary (to justify full-time employment and lower recurrent costs) to have some basic science subjects taught by teachers of agricultural subjects, or to look for other alternatives.

Calculation of the Physical Facilities Required

This calculation is based on the weekly teaching load (Table 3) and is normally calculated by the architects, with the cooperation of the educators, and leads to the determination of the various educational units required such as:

^{1/} This load varies among countries where regulations might present difficulties in changing this factor.

classrooms, laboratories, workshops, library and farm building facilities. In this calculation, a reasonable utilization rate is expected from each of the educational units for each unit to be acceptable.

With the purpose only of illustrating certain features of this type of calculation, the following example is given of the calculation of required lecture rooms, laboratories and workshops.

From the teaching load (Table 3) of the hypothetical curriculum example (Table 2), it will be noticed that the following number and types of education units would be required at a reasonable utilization rate:

	Weekly ^{1/} Periods	Type of Unit	No. of Units Required	Utili- zation Rate
<u>Theory</u>	135 (1st cy.)	Classroom	5	$\frac{135}{170} = 79\%$
<u>Laboratories</u>				
I. Physics/Soil Science (1st cycle/2nd cycle)	24 (1st cy.)	Lab.		$\frac{24}{34} = 71\%$
	24 (2nd cy.)	Type I		$\frac{24}{34} = 71\%$
II. Chemistry/Agronomy/Food Technology (1st cycle/ 1st and 2nd cycle/2nd cycle)	48 (1st cy.)	Lab.	2	$\frac{48}{68} = 71\%$
	36 (2nd cy.)	Type II		$\frac{36}{68} = 53\%$
III. Biology/Applied Biology/ Plant Protection (1st cycle/ 2nd cycle/1st and 2nd cycle)	48 (1st cy.)	Lab.		$\frac{48}{68} = 71\%$
	48 (2nd cy.)	Type III		$\frac{48}{68} = 71\%$
<u>Workshop</u>				
I. Agricultural Engineering (1st and 2nd cycles)	24 (1st cy.)	Workshop	1 ^{2/}	$\frac{24}{34} = 71\%$ ^{2/}
	12 (2nd cy.)			$\frac{12}{34} = 35\%$ ^{2/}

^{1/} Cy. = cycle.

^{2/} To be utilized also for the maintenance of the school farm machinery.

From the preceding examples, it is possible to calculate the costs of some of the fundamental elements of recurrent costs - since the number of teachers and their salaries are known and these constitute the major part of recurrent costs. The same holds true for capital costs, since buildings, furniture and equipment are the major elements in total capital costs.

Distribution of the Timetable by Subjects, Facilities and Teachers

This is a matter to be determined by the school. It is not an easy task because there are many points to be taken into account simultaneously, for example to adjust the number of lectures for each given hour of the schedule according to available lecture rooms; to avoid overlap in the utilization of a given type of laboratory or workshop at a given time; to achieve a reasonable daily distribution of the weekly teaching load for each teacher, and adequate sequences between lectures and practical; and, to make this distribution, taking into account that some teachers will be devoted mostly to lecturing while their assistants do practical work. An example of this type of accommodation is shown in Table 5. In this Table the various types of teachers with the lower number (A_1 , B_1 , etc.) will be engaged mostly in lecturing whereas the assistants, engaged only in practical work, would be those indicated by the higher number (A_3 , B_4 , etc.).

TABLE 1

TOTAL NUMBER OF COURSE PERIODS^{1/} REQUIRED FOR EACH SUBJECT
AND THEIR BREAKDOWN - LECTURES AND PRACTICE

(Note that this curriculum is used as an
example - it is not suggested as a model)

Groups	Theory	P r a c t i c a l				Total
		Lab.	Workshop	Field	Total	
<u>Group A (General Subjects)</u>						
Mathematics	72	-	-	-	-	72
Physics	72	72	-	-	72	144
Biology	72	108	-	-	108	180
Chemistry	72	108	-	-	108	180
Sub-Total	288	288	-	-	288	576
<u>Group B (Technical Subjects)</u>						
Applied Biology	72	72	-	-	72	144
Soil Science	108	72	-	36	108	216
Agronomy	180	72	-	216	288	468
Crop Husbandry	252	-	-	324	324	576
Animal Husbandry	180	-	-	180	180	360
Plant Protection	108	108	-	72	180	288
Agricultural Engineering	144	-	108	72	180	324
Food Technology	72	72	-	108	180	252
Sub-Total	1,116	396	108	1,008	1,512	2,628
<u>Group C (Socio-Economic Subjects)</u>						
Economics and Farm Management	72	-	-	72	72	144
Rural Sociology	36	-	-	36	36	72
Agricultural Extension	-	-	-	36	36	36
Sub-Total	108	-	-	144	144	252
Grand Total	1,512	684	108	1,122	1,944	3,456

^{1/} 50 minutes each.

TABLE 2

WEEKLY TIMETABLE FROM TABLE 1, NUMBER OF PERIODS PER WEEK

(1 Period = 50 Minutes)

Year	Sem-ester	Subject	Lec-ture	P r a c t i c a l				Total
				Lab.	Workshop	Field	Total	
1st	1st	Mathematics	4	-	-	-	-	4
		Physics	4	4	-	-	4	8
		Biology	4	6	-	-	6	10
		Chemistry	4	6	-	-	6	10
			16	16	-	-	16	32
	2nd	Applied Biology	4	4	-	-	4	8
		Soil Science	6	4	-	2	6	12
		Agronomy	4	2	-	6	8	12
			14	10	-	8	18	32
	3rd	Agronomy	6	2	-	6	8	14
		Crop Production	4	-	-	3	3	7
		Animal Husbandry	4	-	-	3	3	7
		Agricultural Engineering	2	-	2	-	2	4
			16	2	2	12	16	32
	4th	Crop Production	5	-	-	6	6	11
		Animal Husbandry	6	-	-	7	7	13
		Agricultural Engineering	4	-	2	2	4	8
			15	-	2	15	17	32
	5th	Crop Production	5	-	-	9	9	14
		Agricultural Engineering	2	-	2	2	4	6
		Plant Protection	2	2	-	-	2	4
		Farm Management and Economics	2	-	-	2	2	4
		Food Technology	2	-	-	2	2	4
			13	2	2	15	19	32
	6th	Rural Sociology	2	-	-	2	2	4
		Plant Protection	4	4	-	4	8	12
		Farm Management and Economics	2	-	-	2	2	4
		Food Technology	2	4	-	4	8	10
		Agricultural Extension	-	-	-	2	2	2
			10	8	-	14	22	32

TABLE 3

CALCULATION OF THE WEEKLY TEACHING LOAD FROM TABLE 2, NUMBER OF PERIODS PER WEEK

(Three-year course (6 semesters); 3 streams
of 40 students each per grade = 320 students)

Teachers		Subject	Lecture	P r a c t i c a l				Total
Type	Number ^{1/}			Lab.	Workshop	Field	Total	
<u>1st, 3rd and 5th Semesters</u>								
A	1P	Mathematics	12	-	-	-	-	12(12) ^{2/}
B	2P	Physics	12	12(24)	-	-	12(24)	24(36)
C	2F	Biology	12	18(36)	-	-	18(36)	30(48)
D	2F	Chemistry	12	18(36)	-	-	18(36)	30(48)
E	3F	Agronomy	18	6(12)	-	18(36)	24(48)	42(66)
F	4P	Crop Production	27	-	-	36(72)	36(72)	63(99)
G	2F	Animal Husbandry	12	-	-	9(18)	9(18)	21(30)
H	2F	Agricultural Engineering	12	-	12(24)	6(12)	18(36)	30(48)
I	1P	Plant Protection	6	6(12)	-	-	6(12)	12(18)
J	1F	Farm Management	6	-	-	6(12)	6(12)	12(18)
K	1F	Food Technology	6	-	-	6(12)	6(12)	12(18)
21(18F+3P)			135	60(120)	12(24)	81(162)	153(306)	288(441)
<u>2nd, 4th and 6th Semesters</u>								
C	2F	Applied Biology	12	12(24)	-	-	12(24)	24(36)
D	2F	Soil Science	18	12(24)	-	6(12)	18(36)	36(54)
E	3F	Agronomy	12	6(12)	-	18(36)	24(48)	36(60)
F	2F	Crop Production	15	-	-	18(36)	18(36)	33(51)
G	3F	Animal Husbandry	18	-	-	21(42)	21(42)	39(60)
H	2F	Agricultural Engineering	12	-	6(12)	6(12)	12(24)	24(36)
I	3F	Plant Protection	12	12(24)	-	12(24)	24(48)	36(60)
J	1F	Farm Management	6	-	-	6(12)	6(12)	12(18)
K	1F+1P	Food Technology	6	12(24)	-	12(24)	24(48)	30(54)
L	1P	Agricultural Extension	-	-	-	6(12)	6(12)	6(12)
M	1P	Rural Sociology	6	-	-	6(12)	6(12)	12(18)
22(19F+3P)			117	54(108)	6(12)	111(222)	171(342)	288(459)

^{1/} P = full-time; P = part-time.

^{2/} Figures in parentheses indicate the number of sessions.

TABLE 4

NUMBER AND TYPES OF TEACHERS REQUIRED

(Calculated from Table 3)

Type of Teacher	Subject	Number and Type of Employment		
		Full-Time	Part-Time	Total
A	Mathematics	-	$1\frac{1}{4}$ ^{2/}	1
B	Physics	-	$2\frac{1}{2}$ (1-1/2)	2
C	Biology and Applied Biology	2	-	2
D	Chemistry and Soil Science	2	-	2
E	Agronomy	3	-	3
F	Crop Production	2	$2\frac{1}{2}$ (1)	4
G	Animal Husbandry	2	$1\frac{3}{4}$ (1/2)	3
H	Agricultural Engineering	2	-	2
I	Plant Protection	1	$2\frac{3}{4}$	3
J	Farm Management	1	-	1
K	Food Technology	1	$1\frac{3}{4}$ (1/2)	2
L	Agricultural Extension	-	$1\frac{3}{4}$ (1/4)	1
M	Rural Sociology	-	$1\frac{3}{4}$ (3/4)	1
	Total	16	11(4-3/4)	27 ^{4/}

1/ Required for the first half of the year.

2/ Figures in parentheses indicate the number of teachers at full-time equivalent.

3/ Required for the second half of the year.

4/ Number of teachers (full-time equivalent) = 21;
teacher/pupil ratio $\frac{360}{21} = 1:17.1$

TABLE 5(a)

STREAM I

TIME-TABLE

	FIRST YEAR						SECOND YEAR						THIRD YEAR											
	First Semester				Second Semester		Third Semester				Fourth Semester		Fifth Semester				Sixth Semester							
	Maths.	Physics	Biology	Chemistry	App. Biol.	Soil Sc.	Agronomy	Crop Prod.	An. Husb.	Agric. Eng.	Crop Prod.	An. Husb.	Agric. Eng.	Crop Prod.	Agric. Eng.	Pl. Protec.	Farm Manag.	Food Tech.	Pl. Protec.	Farm Manag.	Food Tech.	Agric. Ext.	Rural Soc.	
Monday																								
8-9				L				L							T									
9-10				L				L								T								
10-11		T								T							T							
1-2				L						T						F								
2-3				L												F								
3-4			T													F								
Tuesday																								
8-9					T					T								T						
9-10				T												W								
10-11			T							T						W								
1-2		T									F					T								
2-3				L							F										F			
3-4				L							F										F			
Wednesday																								
8-9					T					T								F						
9-10			L								T							F						
10-11			L								T								T					
1-2					L							F					F							
2-3					L							F					F							
3-4				T							T						F							
Thursday																								
8-9		T								T						F								
9-10			T									T							L					
10-11				T							T								L					
1-2					L								T					F						
2-3					L							T						F						
3-4					T							T								T				
Friday																								
8-9					T					F						F								
9-10			T							F						F								
10-11				T								F				F								
1-2					L								W					T						
2-3					L								W					T						
3-4		T										T									T			
Saturday																								
8-9			L							F											T			
9-10			L							F						T								
10-11										F														
11-12										F														

TABLE 5(b)

STREAM II

TIME-TABLE

	FIRST YEAR						SECOND YEAR						THIRD YEAR											
	First Semester				Second Semester		Third Semester			Fourth Semester			Fifth Semester			Sixth Semester								
	Maths.	Physics	Biology	Chemistry	App.Biol.	Soil Sc.	Agronomy	Agronomy	Crop Prod.	An. Husb.	Agric.Eng.	Crop Prod.	An. Husb.	Agric.Eng.	Crop Prod.	Agric.Eng.	Pl.Protec.	Farm Manag.	Food Tech.	Pl.Protec.	Farm Manag.	Food Tech.	Agric.Ext.	Rural Soc.
Monday																								
8-9			T							F						F								
9-10			L					F								F								
10-11			L					F								F								
1-2		T									T						W							
2-3				T						T							W							
3-4		T						T									T							
Tuesday																								
8-9		L							T															
9-10		L								F								T						
10-11			T							F						T								
1-2								T										T						
2-3		T									W						T							
3-4				T							W						T							
Wednesday																								
8-9		T									T									F				
9-10				L				L											F					
10-11				L				L								T								
1-2				T				T										T						
2-3			L						T									F						
3-4			L							T								F						
Thursday																								
8-9		T							F															
9-10				L					F										T					
10-11				L					F								T							
1-2			T					T									F							
2-3				T													F							
3-4																	F							
Friday																								
8-9		L								T							T							
9-10		L							T									F						
10-11		T						T										F						
1-2			T						T									F						
2-3			L					T										F						
3-4			L							F								F						
Saturday																								
8-9		T							F										T					
9-10			T						F											T				
10-11				L					F									L						
11-12				L					F									L						

TABLE 5(c)

STREAM III

TIME-TABLE

	FIRST YEAR			SECOND YEAR			THIRD YEAR																	
	First Semester		Second Semester	Third Semester		Fourth Semester	Fifth Semester			Sixth Semester														
	Maths.	Physics	Biology	Chemistry	App. Biol.	Soil Sc.	Agronomy	Agronomy	Crop Prod.	An. Husb.	Agric. Eng.	Crop Prod.	An. Husb.	Agric. Eng.	Crop Prod.	Agric. Eng.	Pl. Protec.	Farm Manag.	Food Tech.	Pl. Protec.	Farm Manag.	Food Tech.	Agric. Ext.	Rural Soc.
<u>Monday</u>																								
8-9								T									W							
9-10	T								T								W							
10-11		T									T						T							
1-2				T				F									F							
2-3		L						F									F							
3-4		L								F							F							
<u>Tuesday</u>																								
8-9		T						F									F							
9-10			L					F									F							
10-11			L								T						F							
1-2		L								T								T						
2-3		L							T								T							
3-4			T					T																
<u>Wednesday</u>																								
8-9								F									T							
9-10			T					F										T						
10-11				T					T															
1-2		T																		T				
2-3	T									T										F				
3-4				T				T												F				
<u>Thursday</u>																								
8-9			L							T							F							
9-10			L								W						F							
10-11	T									W							F							
1-2				L				T											T					
2-3				L				L																
3-4			T					L									T			T				
<u>Friday</u>																								
8-9			T					T											F					
9-10				L						T									F					
10-11				L					T								T							
1-2	T							T											L					
2-3				T						F									L					
3-4		T								F							T							
<u>Saturday</u>																								
8-9				L					F								F							
9-10				L					F								F							
10-11			L						F															
11-12			L																T					

TABLE 5(d)

DISTRIBUTION OF TIME-TABLE BY SUBJECTS, FACILITIES AND TEACHERS

	First Semester			Third Semester			Fifth Semester		
	I	II	III	I	II	III	I	II	III
Monday									
8-9	L-D2-III L-C2-III1	T-C1-CL1		L-E2-II2 F-G2	T-G1-CL2	T-E1-CL3	T-F2-CL4 F-F2	F-F2 F-F3	W-H2 F-J
9-10	L-D2-III L-C2-III1	L-C1-III2 L-B2-I	T-A-CL1	L-E2-II2 F-G2	F-E2 F-E3	T-F1-CL2	T-H1-CL3 F-F2	F-F2 F-F3	W-H2 F-J
10-11	T-A-CL1	L-C1-III2 L-B2-I	T-B1-CL1	T-G1-CL2	F-E2 F-E3	T-H1-CL3	T-I-CL4 F-F2	F-F2 F-F3	T-F2-CL5
1-2	L-C2-III1 L-D2-III	T-B1-CL1	T-D1-CL2	T-E1-CL3	T-H1-CL4	F-E2 L-E3-II2	F-F2 F-F3	W-H2 F-J	F-F1 F-F4
2-3	L-C2-III1 L-D2-III	T-D1-CL1	L-B2-I L-C1-III2		T-G1-CL2	F-E2 L-E3-II2	F-F2 F-F3	W-H2 F-J	F-F1 F-F4
3-4	T-B1-CL1	T-A-CL2	L-B2-I L-C1-III2		T-E1-CL3	F-G1 F-G2	F-F2 F-F3	T-H1-CL4	F-F1 F-F4
Tuesday									
8-9	T-D1-CL1	L-B2-I L-C2-III2	T-B1-CL2	T-F2-CL3	T-F1-CL4	F-E2 F-H1	T-J-CL5		F-F4 F-F3
9-10	T-C1-CL1	L-B2-I L-C2-III2	L-C2-III1 L-D2-III	T-G1-CL2	F-G2 L-E2-II2	F-E2 F-H1	W-H2 F-J	T-J-CL3	F-F4 F-F3
10-11	T-B1-CL1	T-C1-CL2	L-C2-III1 L-D2-III	T-E1-CL3	F-G2 L-E2-II2	T-H1-CL4	W-H2 F-J	T-F1-CL5	F-F4 F-F3
1-2	T-A-CL1		L-B2-I L-D1-II2	F-F4 F-F3	T-E1-CL2	T-G1-CL3	T-F2-CL3	T-I-CL4	T-H1-CL5
2-3	L-C2-III1 L-D2-III	T-A-CL1	L-B2-I L-D1-II2	F-F4 F-F3	W-H2 F-E2	T-F1-CL2	F-K1 L-I-III2	T-H1-CL3	T-F2-CL4
3-4	L-C2-III1 L-D2-III	T-D1-CL1	T-C1-CL2	F-F4 F-F3	W-H2 F-E2	T-E1-CL3	F-K1 L-I-III2	T-F1-CL4	
Wednesday									
8-9	T-D1-CL1	T-A-CL2		T-E2-CL3	T-H1-CL4	F-E1 F-E3	F-J W-H2	F-K1 F-K2	T-F2-CL5
9-10	L-B1-I L-C2-III1	L-D2-II2 L-C1-III2	T-C1-CL1	T-F1-CL2	L-E2-III F-G2	F-E1 F-E3	F-J W-H2	F-K1 F-K2	T-I-CL3
10-11	L-B1-I L-C2-III1	L-D2-II2 L-C1-III2	T-D1-CL1	T-E1-CL2	L-E2-III F-G2	T-F1-CL3	T-I-CL4	T-F1-CL5	
1-2	L-D2-III L-C2-III1	T-D1-CL1	T-B1-CL2	F-G2 L-E2-II2	T-E1-CL3		F-P4 F-F3	T-I-CL4	T-K1-CL5
2-3	L-D2-III L-C2-III1	L-C1-III2 L-B2-I	T-A-CL1	F-G2 L-E2-II2	T-F1-CL2	T-G1-CL3	F-P4 F-F3	F-J W-H2	F-K1 F-K2
3-4	T-C1-CL1	L-C1-III2 L-B2-I	T-D1-CL2	T-F1-CL3	T-G1-CL4	T-E1-CL5	F-P4 F-F3	F-J W-H2	F-K1 F-K2
Thursday									
8-9	T-A-CL1	T-B1-CL2	L-C2-III1 L-B2-I	T-E1-CL3	F-F2 F-F3	T-G1-CL4	T-F1-CL5		F-F1 F-F4
9-10	T-B1-CL1	L-D2-II2 L-D1-III	L-C2-III1 L-B2-I	T-G1-CL2	F-F2 F-F3	W-H2 F-E3	L-I-III2 F-K1	T-K1-CL3	F-F1 F-F4
10-11	T-C1-CL1	L-D2-II2 L-D1-III	T-A-CL2	T-E1-CL3	F-F2 F-F3	W-H2 F-E3	L-I-III2 F-K1	T-F1-CL4	F-F1 F-F4
1-2	L-C2-III1 L-B2-I	T-C1-CL1	L-D2-III L-C1-III2	T-H1-CL2	T-E1-CL3	T-E2-CL4	F-H1 F-H2	F-F2 F-F4	T-I-CL5
2-3	L-C2-III1 L-B2-I	T-D1-CL1	L-D2-III L-C1-III2	T-F1-CL2		L-E3-II2 F-E1	F-H1 F-H2	F-F2 F-F4	T-J-CL3
3-4	T-D1-CL1		T-C1-CL2	T-G1-CL3		L-E3-II2 F-E1	T-J-CL4	F-F2	T-H1-CL5 F-F4
Friday									
8-9	T-D1-CL1	L-B2-I L-C2-III1	T-C1-CL2	F-E2 F-E3	T-G1-CL3	T-E1-CL4	F-P4 F-F3	T-F1-CL5	F-J W-H2
9-10	T-B1-CL1	L-B2-I L-C2-III1	L-D2-III L-D1-II2	F-E2 F-E3	T-F1-CL2	T-G1-CL3	F-P4 F-F3	F-H1 L-I-III2	F-J W-H2
10-11	T-C1-CL1	T-B1-CL2	L-D2-III L-D1-II2	F-G2 F-G1	T-E1-CL3	T-F1-CL4	F-P4 F-F3	F-H1 L-I-III2	T-F2-CL5
1-2	L-D2-III L-B2-I	T-C1-CL1	T-A-CL2	W-H2 F-E2	T-F1-CL3	T-E1-CL4	T-H1-CL5	F-P4 F-F3	L-I-III1 F-H1
2-3	L-D2-III L-B2-I	L-C2-III2 L-D1-II2	T-D1-CL1	W-H2 F-E2	T-E1-CL2	F-G2 F-G1	T-F2-CL3	F-P4 F-F3	L-I-III1 F-H1
3-4	T-A-CL1	L-C2-III2 L-D1-II2	T-B1-CL2	T-H1-CL3	F-G2 F-G1	F-G1	T-K1-CL4	F-P4 F-F3	T-F2-CL5
Saturday									
8-9	L-B2-I L-D2-III	T-A-CL1	L-D2-II2 L-C2-III1	F-E2 W-H2	F-E1 F-E3	F-P4 F-P2	T-K1-CL3	T-J-CL4	F-H1 L-I-III2
9-10	L-B2-I L-D2-III	T-B1-CL1	L-D2-II2 L-C2-III1	F-E2 W-H2	F-E1 F-E3	F-P4 F-P2	T-F1-CL3	T-K1-CL4	F-H1 L-I-III2
10-11		L-D2-II2	L-C2-III1	F-E1	F-E2	F-P4		L-I-III2	T-J-CL5
11-12		L-D2-II2	L-C2-III1	F-E1	F-E2	F-P2		F-H1	

TABLE 5(d) Contd.

DISTRIBUTION OF TIME-TABLE BY SUBJECTS, FACILITIES AND TEACHERS

		<u>First Semester</u>				<u>Third Semester</u>		<u>Total</u>			<u>Fifth Semester</u>
<u>Code:</u>	<u>Type of</u>	<u>Streams</u>			<u>Total</u>						
<u>1st Column:</u>	<u>Teacher</u>	<u>I</u>	<u>II</u>	<u>III</u>							
T = Theory	A	4	4	4	12 = 12	E1	7 + 8 + 9 =	24	I	6 + 6 + 6 =	18 = 18
L = Laboratory	B1	6	4	4	14	E2	11 + 8 + 7 =	26	J	6 + 6 + 6 =	18 = 18
W = Workshop	B2	6	8	8	22	E3	4 + 6 + 6 =	16	K1	6 + 4 + 4 =	14
F = Field	C1	4	9	10	23	G1	5 + 5 + 7 =	17	K2	- + 2 + 2 =	4
	C2	11	6	8	25	G2	5 + 5 + 3 =	13			
<u>2nd Column:</u>	D1	4	10	8	22	F1	3 + 4 + 4			2 + 5 + 6 =	24
Type of teacher	D2	12	6	8	26	F2	1 + 3 + 3			6 + 6 + 5 =	24
(See Table 4)						F3	3 + 3 + -			9 + 6 + 3 =	24
<u>3rd Column:</u>						F4	3 + - + 3			6 + 6 + 9 =	27
Type of facilities						H1	2 + 2 + 4			4 + 6 + 6 =	24
(See Table on page 38)						H2	4 + 4 + 2			6 + 4 + 4 =	24

Factors Influencing Pupil/Teacher Ratios

The pupil/teacher ratio has a considerable influence on recurrent costs and it is important to examine closely the factors that determine the ratios.

If it is assumed that the total number of hours taught per year, the school size, and the actual curriculum make-up remains the same, variations in other factors can show considerable contrasts in the resultant pupil/teacher ratios. In Table 6 below the following factors are considered:

- (a) Percentage of practical work in the curriculum.
- (b) Weekly teaching load per teacher.
- (c) Number of school weeks per year.
- (d) Number of periods per week.
- (e) Class unit size.
- (f) Number of sub-groups for practical work per class.

TABLE 6

Variable	% Practical Work in Curricula	Weekly Teaching Load Per Teacher (Periods)	No. of School Weeks Per Year	No. of Periods Per Week	Class Size	No. of Groups Practical Work Per Class	Pupil/Teacher Ratio
Standard	56	21	36	32	40	2	17.1
A. Percentage practical work in curriculum	65	21	36	32	40	2	15.6
	45	21	36	32	40	2	18.0
B. Weekly teaching load per teacher	56	24	36	32	40	2	18.9
	56	18	36	32	40	2	14.4
C. Number of school weeks per year, and number of periods per week	56	21	40	29	40	2	18.0
	56	21	32	36	40	2	15.0
	56	21	29	40	40	2	17.3
	56	21	39	30	40	2	18.0
D. Class size	56	21	36	32	30	2	12.4
E. Number of groups practical work per class	56	21	36	32	40	4	9.7
	56	21	36	32	40	1	25.7

In a small school it is difficult to arrive at an adequate pupil/teacher ratio with a reasonable number of full-time staff. In a three-year school with one stream of 40 students per year (120 total), to have efficient teacher utilization, either the teachers would have to cover two or more subjects in the curricula, or a large proportion of them would have to be employed part-time; neither alternative is completely satisfactory. For example, if the weekly teaching load for each subject in Table 3 were to be reduced to one-third (assuming one

stream per grade instead of three), the weekly teaching load would perhaps justify only two full-time teachers (agronomy and crop production), even though they would be obliged to cover all the practical work as well. Teachers for the remaining subjects would have to be all part-time, all full-time, or a combination of full-time and part-time teachers. The first two formulae are inadvisable and, to implement the third, it is doubtful whether many more teachers could be added to the full-time group without having detrimental effects on the quality of the programme. Thus, the school would be staffed by only a very small core of full-time staff, which would be insufficient to handle effectively the educational tasks, or those related to the promotion of change in the agricultural community.

ANNEX 1

Country	State of Development (Harbison and Myers)	Population Density h/sq.km.	Fertilizer Consumption 1969/70, kilograms/hectare (NPK)	Unit Cost (US.\$)		Lower Agricultural Technician Level																	
						Entrance Requirement		Course			Number of Teaching Hours in the Course											No. of Years Practical Experience Required for the Certificate	Percentage of General Over Total Subjects
				General Secondary Education	Agricultural Educa- tion (Technician Level)	No. of Years Basic Education	No. of Years Prac- tical Experience	Residential (R) Non-Residential (NR)	Full-Time (F) Part-Time (P)	Number of Years	General and Basic Science Subjects	Percentage of Prac- tical in General Subjects	Technical Subjects				Socio-Economic Subjects	Total					
													Theory	Practice	Total	Percentage of Prac- tice in Technical Subjects							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Ivory Coast ('68)	1	12	1.56	530	1,750	8	0	R	F	3 ^{1/2}	990	-	450	1,435 ^{1/2}	1,885	76.7	120	2,995	1	33.1	-	-	
Niger ('67)	1	3	-	320	700	8	0	R	F/P	3	360	-	818	1,335	2,153	62.0	312	2,825	1/2	12.7	-	-	
Senegal ('69)	1	18	2.38	500	1,200	6	0	R	F	4	1,590	21.8	840	1,080	1,920	56.3	300	3,810	1/2	41.7	1:15.5	-	
Colombia	2	15	31.00	715	-	9	0	R/NR	F	3	2,070	-	690	690	1,380	50.0	300	3,750	0	55.2	-	-	
Ecuador ('66)	2	17	14.20	87	-	6	0	R	F	6	2,400	50.0	2,400	1,300	3,700	35.1	-	6,100	-	39.3	1:15	-	
Iran ('65)	2	15	7.50	50	500	9	0	R/NR	F	3	1,380	45.4	1,370	990	2,360	41.9	580	4,320	0	31.9	1:21.8	20p	
Peru ('68)	2	10	31.00	85	245	6	0	R	F	5	3,240	-	2,400	-	2,400	-	210	5,850	0	55.4	-	-	
Tunisia	2	28	7.80	130	-	9	0	R	F	3	-	-	-	-	-	-	-	-	-	-	-	-	
Chile	3	11	33.00	80	274	8	0	R	F	4	2,160	-	2,250	-	2,250	-	340	4,650	-	46.5	1:15	-	
Korea (South)	3	300	231.00	40	60	9	0	NR	F	3	1,800	-	600	1,000	1,600	62.5	200	3,600	0	50.0	1:33	20-24h	
Jordan	-	22	2.10	70	480	9	0	R	-	3	-	30.00	-	-	-	-	-	-	-	-	1:15	-	
Guatemala	2	41	16.00	95	1,940	9	0	R	F	3	435	53.7	1,500	1,800	3,300	54.5	240	3,975	-	10.9	1:16	20h	
El Salvador	-	137	95.00	45	1,530	9	0	R	F	3	600	-	1,335	1,800	3,135	57.4	105	3,840	-	15.6	-	-	
Malaysia ('70)	2	32	37.00	483	2,000	9	0	R	F	3	600	48.5	1,180	1,680	2,860	58.7	170	3,630	-	16.5	1:16	18.3p	
Poland	3	100	159.00	590	-	7	-	-	-	5	3,266	-	1,712	876	3,588	33.8	286	6,140	1/2	53.2	-	-	
Yugoslavia	3	72	81.00	132	-	8	2	R	F	4	1,908	-	864	2,598	3,462	75.0	288	5,658	2	33.7	-	-	
Sweden	4	17	155.00	-	-	9	3	-	F	1	140	-	330	360	690	52.2	495	1,325	-	10.6	-	-	
Israel ('62)	4	124	124.00	180	1,100	8	0	R	F	4	2,700	-	900	2,000	2,900	69.0	-	5,600	-	48.2	-	-	
Japan	4	266	406.00	118	-	9	0	NR	F	3	1,610	-	715	1,000	1,715	58.3	210	3,535	-	45.5	-	-	
Netherlands	4	362	690.00	392	-	8	1	NR	F	3	2,286	-	990	108	1,098	9.8	396	3,780	-	60.5	-	-	
Belgium	4	301	590.00	950	-	9	0	R	F	3	2,310	-	805	840	1,645	51.1	245	4,200	-	55.0	-	-	

^{1/} Includes one year in-service course.

- No information available.

ANNEX 2

Country	State of Development (Harbison and Myers)	Population Density h/sq.km	Fertiliser Consumption 1969/70, kilograms/hectare (MPK)	Unit Cost (US.\$)		Upper Agricultural Technician Level															No. of Years Practical Experience Required for the Certificate	Percentage of General Over Total Subjects	Teacher/Student Ratio	Teaching Load
						Entrance Requirement		Course			Number of Teaching Hours in the Course													
				General Secondary Education	Agricultural Educa- tion (Technician Level	No. of Years Basic Education	No. of Years Prac- tical Experience and/or Agricultural Courses	Residential (R) Non-Residential (NR)	Full-Time (F) Part-Time (P)	Number of Years	General and Basic Science Subjects	Technical Subjects					Socio-Economic Subjects	Total						
												Theory	Practice	Total	Percentage of Practice in Tech- nical Subjects									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
Ivory Coast ('68)	1	12	1.56	530	1,750	10	0	R	F	2 ^{1/}	1,470	765	660	1,425	46.3	210	3,105	2	47.3	1:15.6	18h (prof) 27h (ass)			
Senegal ('69)	1	18	2.30	500	1,200	10	0	R	F	4	1,650	900	1,080	1,980	54.5	300	3,930	1 ^{1/}	42.0	-	-			
Sudan ('64)	1	5	6.30	283	-	12	0	R	F	3	570	1,420	800	2,220	36.0	450	3,240	0	17.6	-	-			
Uganda ('69)	1	36	0.93	200	1,000	11	0	R	F	3	550	970	800	1,770	45.2	340	2,660	0	20.7	-	-			
Peru ('68)	2	10	31.00	85	245	11	0	R	F	2	825	627	660	1,287	51.3	1,089	3,201	1 ^{1/}	25.8	-	-			
Korea (South)	3	300	231.00	40	60	9	0	NR	F	5	2,700	2,000	2,000	4,000	50.0	-	5,700	0	47.4	1:20.8	13p (prof) 18p (ass)			
Spain ('69)	3	62	61.00	48	-	11	0	-	F	4	784 ^{2/}	1,246	840	2,086	40.3	266	3,136	-	25.0	-	-			
Yugoslavia	3	72	81.00	132	-	12	3	NR	F	2	315	1,035	477	1,512	31.5	285	2,112	3	14.9	-	-			
Australia	4	1.5	25.00	240	-	11	-	-	F	3	330	1,125	1,830	2,955	61.9	195	3,480	-	9.5	-	-			
Netherlands	4	362	690.00	392	-	10	1	NR	F	3	2,252	1,412	100 ^{3/}	1,512	6.6	296	4,060	1	55.5	-	-			
Belgium	4	301	590.00	950	-	12	0	R	F	3	1,050	1,715	735	2,450	28.9	245	3,745	-	28.0	-	-			
Italy	3	168	82.00	375	-	8	0	R	F	5	3,535	-	1,225	-	-	560	6,440	-	54.9	-	-			
Switzerland ('70)	4	132	341.00	-	2,150	9	4 ^{4/}	R	F	2	283	1,661	-	1,661 ^{5/}	-	558	2,502 ^{5/}	0	11.3 ^{5/}	1:3.4 ^{6/}	-			
Iraq ('70)	2	21	1.94	91	-	12 ^{7/}	0	R	F	2	-	1,414	-	1,414	66.4	-	2,129	1 ^{1/}	-	1:15	-			

1/ Including two years on-the-job training.

2/ First year.

3/ Practical experience is obtained during vacation periods.

4/ Including two semesters vocational school.

5/ For the second year average of six specializations.

6/ Includes assistants.

7/ Including three years vocational school.

- No information available.

ANNEX 3

SPACE REQUIREMENTS - AGRICULTURAL FACILITIES

The following simple indicators can be used to calculate farm building areas. It is important, however, not to neglect storage facilities for fodder, feeding stuffs, fertilizers, implements, and farm offices for records. Green-houses and nurseries may also be required for crop husbandry and horticultural purposes. Specialized streams, such as animal health, may require a clinic or slaughter house, while forestry will need a saw-mill and timber stores as a minimum.

The question of the adaptation of standard farm buildings for teaching purposes is important and is discussed within a detailed example included as Part V.

Cattle

Per cow place	sheds	8 sq. metres
Per cow place	yards	7 sq. metres
Bullpen		45 sq. metres
Young stock		
up to 14 days		1½ sq. metres/head
14 days - 3 months		2 sq. metres/head
3-6 months		2½ sq. metres/head
6 months - 1 year		2¾ sq. metres/head in yard
1 year - 2½ years		3¾ sq. metres/head

Milking Parlour

6 cow unit	27 sq. metres
------------	---------------

Dairy

Wholesale

Retail

20-40 cows	12 sq. metres	18 sq. metres
40-60 cows	20 sq. metres	24 sq. metres

Pigs

1 sq. metre per head - fattening pens.
 3¾ sq. metres per sow - yard.
 12 sq. metres per boar - pen.
 10 sq. metres per farrowing unit (1 per 10 sows).
 2¾ sq. metres - pigs 8-10 weeks old.

Poultry

Incubator - 1,200 eggs cabinet incubator 7.5 sq. metres.

Brooders and rearing:

0-4 weeks	4-8 weeks	9-16 weeks
40 per sq. metre	10 per sq. metre	4 per sq. metre (floor rearing on litter)

Laying Birds

3 birds per sq. metre on deep litter.

Battery cages two double three-tier system, 12 inch cages, one bird per cage, 540 birds require 80 sq. metres.

Brooders $\frac{1}{2}$ -2 kilos live-weight, deep litter, 10 per sq. metre.

Grain, Silos

Silo 4.5 metres diameter, 9 metres high = 100 tons approximately.

Hay storage in bales 1 ton = 8 cubic metres.

Silage 1 ton = 2 cubic metres.

Fertilizer (stacked 8 bags high), 1 sq. metre floor space = 1 ton.

Straw bales (barley) 1 ton = 15 cubic metres.

Tractors and Implements

Tractor	6 sq. metres
Combine (14 ft.)	45 sq. metres
Trailer (4 wheels)	12 sq. metres
Land Rover	7 sq. metres
Lorry	24 sq. metres
Plough (3 body)	3 $\frac{1}{2}$ sq. metres

Farm Workshop (non-teaching, maintenance only)

4 tractor farm, allow 40 sq. metres.

Teaching Workshop

The space requirements will vary, dependent on the level of the course; for simple wood and metal work only, for example, 5 sq. metres per pupil would be sufficient; but if a specialized course is run in farm machinery, 15 sq. metres per pupil should be allowed.

ANNEX 4

PERU - RECURRENT COST FOR THE TRAINING OF A LOWER-LEVEL
AGRICULTURAL TECHNICIAN, STARTING AFTER PRIMARY SCHOOL

(See Annex 1)

Present Cost

5 years agriculture course (5 x US.\$ 245) + 20% (drop-out)	=	US.\$ 1,470
--	---	-------------

Cost in the Case of a Shorter Agriculture Course

(a) 3 years agriculture course after 3 years of secondary education (3 x US.\$ 85) + 10%) +) (3 x US.\$ 245) + 10%	=	1,090
--	---	-------

(b) 2 years agriculture course after 3 years of general education (3 x US.\$ 85) + 10%) +) (2 x US.\$ 245) + 10%	=	820
--	---	-----

(c) 3 years agriculture course after 2 years of general education (2 x US.\$ 85) + 10%) +) (3 x US.\$ 245) + 10%	=	995
--	---	-----

Economies

Case (a)	=	380
Case (b)	=	650
Case (c)	=	475

PART V

DESIGN OF BUILDINGS

Introduction

In too many cases, examples are found of badly designed technician training institutes. Often the stress put on impressive administrative blocks, large libraries, over-equipped laboratories, tends to negate the principle function of the institution, namely to turn out "practical" type manpower. The results of this over-emphasis on design can be two-fold; firstly, a psychological bias of the students and staff towards theoretical studies, and secondly, an over-spending on these academic aspects, leading to a poor and badly designed farm, which often appears as an afterthought.

The Farm as a Focus

It could be argued that the farm should form the focal point of a technician training institute, and that far more thought should be placed on this concept when the institution is being designed.

In practice, problems often arise because of a lack of cross fertilization between agriculturists and architects. Project architects are usually completely familiar with school or teaching building design, but have little or no experience of agricultural facility design. However, if the concept of the farm as the focal point is accepted, new approaches on many aspects, including course design, teaching methods, equipment needs and farm building design, can be taken.

Farm Buildings Designed for Teaching

It is, for example, far more logical to teach and explain methods of machine milking in a milking parlour rather than in a classroom. A normal type milking parlour, however, will only permit a small number of students to stand awkwardly in the background. Drawing A7, however, shows a possible approach where students can sit, take notes and view proceedings without interfering with the normal workings of the parlour. This addition, which gives satisfactory teaching space for a group of fifteen students, involves only an addition of twelve square metres of construction.

A similar approach is illustrated in Drawing A4, which allows a demonstration area within a group of calf pens. Similar space areas for demonstration viewing should be allowed for in horticultural nurseries, pig pens, poultry areas and feed mills.

Field Laboratories

Instead of concentrating on normal science type laboratories, thought should be given to including field laboratories within the farm complex. For example, a room could be attached or extra space allowed within a milk processing room on a dairy farm, where students could learn both the techniques and applied science back-

ground relating to milk production and products. A crops field laboratory could also be attached to the seed store and include facilities for seed testing and soil tests.

The equipment for such laboratories should be strictly applied, including, for example, standard soil testing kits, or industrial testing set-ups in the case of milk production.

Farm Classrooms

Designs of these may vary from a simple gallery situated in a farm yard to an amphitheatre type building with wide doors to a stage area. Such classroom types are of considerable importance in teaching such subjects as animal husbandry and farm machinery. In the case of animals, a holding crush or temporary pen may be needed. See Drawing A6.

Course Design and Teaching Methods

The consequence of making the farm and farm area the focal teaching point of an institution is one of greater flexibility in both course structure and teaching methods. Project type teaching can be more easily and effectively employed.

The next section of the paper concerns the design of a higher-level technician training institution and illustrates the possible savings in construction costs that could arise from putting into practice the ideas discussed above.

AN "EXAMPLE" STUDY, TO ILLUSTRATE PRINCIPLES OF DESIGN, FOR AN AGRICULTURAL TECHNICIAN TRAINING INSTITUTE

One objective in the training of agricultural technicians is to produce "practically" biased personnel who can cope with the day-to-day problems of agricultural development. In this connection the design of institutional buildings can be an important factor in strengthening the thrust towards a practical bias.

Teaching methods based on practical instruction demand facilities other than standard classrooms or laboratories, and it would appear essential in agricultural training for the farm and its facilities to be placed at the focal point of instruction. To achieve this, it would seem logical to place emphasis on the design of the farm and farm facilities in such a way that the greatest possible use can be made of farm and facilities for teaching purposes.

This case study is, therefore, based on a detailed consideration of a farm and farm facilities, correlated with teaching requirements.

The study aims at reducing the normal formal teaching space (such as is utilized in classrooms and laboratories) to a minimum, by improving the design of such farm facilities as the dairy, milk room, cattle sheds, so that these

productive units can fulfil the dual function of production and instruction. The study, therefore, concentrates on the modification of design of production units so that efficient and effective teaching may be carried out in situ.

Data Base

A detailed farm schedule based on an irrigated farm of 100 hectares in a dry tropical environment constitutes Annex A. For training purposes, the course length would be two years (higher-level technicians) and the capacity of the institution is 240 students.

Each class year would thus contain 120 students, and would be broken down into:

- (a) two groups of 60 students for classroom activities;
- (b) four groups of 30 students for science laboratory, workshop and mapping activities;
- (c) eight groups of 15 students for practical activities and demonstrations, tutorials and project work activities.

The course structure by topic and hours required is detailed in Table I. This Table also details the site at which each topic, or breakdown by hour of the topic, could be taught. The annual total of teaching hours is calculated as being 1,152 hours (32 hours a week and three terms of 12 weeks).

Analysis

The analysis of teaching load on the various facilities is outlined in Table II.

The facilities indicated in Table II, apart from including the formal educational facilities such as classroom, laboratory, drawing office and teaching workshop, would include special facilities, i.e. (i) field laboratory, which would be a simple building with concrete type benches on which field specimens could be examined, equipped with applied scientific/commercial apparatus such as soil testing kits; (ii) a demonstration yard or farm classroom which would be a section of the yard with equipment such as a cattle holding crush, and a stepped shaded stand for the students. Apart from auxiliary facilities such as a library, tutorial room and audio-visual resource room, the other teaching areas would be included in the following production units:

- (a) horticultural nursery area;
- (b) milking parlour;
- (c) milk room;
- (d) calf pens;

- (e) sheep pens;
- (f) poultry unit;
- (g) feed mill and stores;
- (h) slaughter room.

Drawings of the adaptations required to transform these production units into teaching/production units are listed in Annex B.

Conclusions

The analysis of teaching load as indicated in Table II shows that if production units are adapted for teaching purposes, they carry a teaching load of 2,330 hours per year. From the drawing provided it is shown that no additional construction is needed to achieve this dual function of production and teaching (see Table IV: Comparative Space Requirements for Farm Buildings).

To carry this comparison further, Table III indicates the contrast between the method suggested in this study, i.e. using and adopting the production units for teaching purposes (Approach "P" based on Table II), and the traditional approach of classrooms and science laboratories based on the same course structure, Approach "X".

TABLE I
COURSE STRUCTURE

Year I	Classroom Hours	Non-Classroom Hours	Day Excursion	Science Laboratory	Field Laboratory	Drawing Office	Workshops	Nursery	Dairy Milk Parlour	Dairy Milk Room	Poultry Buildings	Demonstration Yard	Slaughter House	Farm Area	Sheep Pens	Food Mill	Free Study/ Tutorial
<u>Agricultural Systems</u>																	
A1 General Introduction	12	36												36			
A2 Rotations	12	20												20			
A3 Irrigation Practices	24	46	10			12								24			
A4 Range Management	24	16	10			6											
A5 Projects	0	72															
Total	72	180															
<u>Agricultural Biology</u>																	
B1 Crop Ecology	12	36		18	6			4						8			
B2 Crop Protection	24	72		36	12									24			
B3 Animal Ecology	12	35		24							8			4			
B4 Animal Health	24	72		24	24				4		4		4	8	4		
Total	72	216															
<u>Agricultural Chemistry</u>																	
C1 Soils	24	84	20	36	12	6								10			
C2 Crop Protection	24	66		36	12									18			
C3 Plant Nutrition/Fertilizers	12	30		24										6			
C4 Animal Nutrition/Feeding Stuffs	12	36		18	6				6							6	
Total	72	216															
<u>Agricultural Engineering</u>																	
D1 Surveying	12	60				24								36			
D2 Mechanics	12	42				24						6		12			
D3 Tractor/Tractor Driving	0	42									6			36			
D4 Workshop Practice	12	72					72										
Total	36	216															
<u>Miscellaneous</u>																	
E1 Rural Sociology	19	5	5														
E2 Agricultural Economics	43	5	5														
Total	62	10															
Total Year I	314	838	50	216	72	72	72	4	10	-	4	20	4	224	4	6	72

TABLE I (Contd.)

COURSE STRUCTURE

Year II	Classroom Hours	Non-Classroom Hours	Day	Excursions	Science Laboratory	Field Laboratory	Drawing Office	Workshops	Nursery	Dairy Milk Parlour	Dairy Milk Room	Poultry Buildings	Demonstration Yard	Slaughter House	Farm Area	Sheep Pens	Food Mill	Project
<u>Farm Management</u>																		
F1 Farm Management	24	28					10								18			
F2 Extension Methods	12	30	30															
F3 Cooperative Marketing	24	10	10															
F4 Research Methodology	12	29	5				6								18			
F5 Agricultural Development	12	5	5															
Total	84	102																
<u>Crop Production</u>																		
G1 Fodder Crop	12	16				6									10			
G2 Grain Crops	24	22				12									10			
G3 Other Crops	12	12				6									6			
G4 Horticulture	24	60				12			36						12			
G5 Crop Storage	6	12			6	6												
G6 Crop Processing	12	30			6			12									12	
G7 Shelter Belts	6	10	5												5			
Total	96	162																
<u>Animal Production</u>																		
H1 Poultry	23	36				12						24						
H2 Cattle	36	44								12			24		8			
H3 Sheep	12	12														12		
H4 Other Livestock	6	6											6					
H5 Dairy Products	12	48			12						36							
H6 Meat	6	24				12								12				
Total	96	170																
<u>Agricultural Engineering</u>																		
I1 Farm Machines	36	108					12	60					36					
I2 Pumps	6	45	5				6	24							10			
I3 Canal Layout	6	26	5				6								15			
I4 Farm Buildings	6	27	5				12								10			
Total	54	206																
Projects/Free Study/Tutorial		182																182
Total Year II	330	822	70	24	66	52	96	36	12	36	24	66	12	122	12	12	182	
Total Year I	314	838	50	216	72	72	72	4	10	-	4	20	4	224	4	6	72	
Grand Total	644	1,660	120	230	138	124	168	40	22	36	28	86	16	346	16	18	254	

TABLE II

ANALYSIS

	(a) Unit/Capacity	(b) Year I Hrs./No. of Groups	(c) Year II Hrs./No. of Groups	(d) Annual Teaching Load	(e) Flexibility 10%	(f) Project Hrs.	(g) Total Annual Load	(h) Use Factor
A	Classroom 60	314 x 2	330 x 2	1,288	129	-	1,417	98%
	Science Laboratory 30	216 x 4	24 x 4	960	96	-	1,056	73%
	Drawing Office 30	72 x 4	52 x 4	496	50	200	746	51%
	Teaching Workshop 30	72 x 4	96 x 4	672	67	200	939	65%
B	Field Laboratory 15	72 x 4	66 x 4	552	55	200	807	70%
	Demonstration Yard 15	20 x 8	66 x 8	728	73	-	801	70%
	Nursery 15	4 x 8	36 x 8	320	32	50	402	34%
	Dairy Parlour 15	10 x 8	12 x 8	176	18	50	244	21%
C	Dairy Milk Room 15	-	36 x 8	288	29	50	367	32%
	Slaughter Room 15	4 x 8	12 x 8	128	13	50	191	17%
	Sheep Pens 15	4 x 8	12 x 8	128	13	50	191	17%
	Food Mill 15	6 x 8	12 x 8	144	14	50	208	18%
	Poultry Unit 15	4 x 8	24 x 8	224	22	50	296	26%
	General Farm Area 15	242 x 8	112 x 8	2,832	-	-	-	-
D	Projects 15	72 x 8	182 x 8	2,032	-	-	-	-
	Tutorial Room 15	-	-	-	-	-	1,082	75%

Notes: Row A: This covers traditional type single-purpose facilities.

Row B: This covers special facilities.

Row C: Adapted production units having sufficient space for teaching activities. Total overall usage equals 1,899 teaching hours per annum.

Row D: Student project activities can be expected in the production units, specialised units, workshop, drawing office and science laboratories. The project hours are accordingly distributed in Column (f). A certain number of these hours, 982 in total, are allocated to study and tutorials, and a special tutorial room is required.

A total of 2,832 hours is allocated to the general farm areas: some of this time may be in practice, spent either in the production units or in specialised units.

Column (h): This has been calculated against a base of 1,440 hours per annum as the total available teaching time for Rows A and B and tutorial room where electricity for evening work could be available; i.e. 5-7 p.m., and 1,152 hours per annum for Row C.

TABLE III
COMPARISON SCHEME "P" WITH "X"

Unit/Capacity		Year I 'X'	Year II "X"	Annual Teaching Load	Flexibility 10%	Projects	Total Teaching Load "X"	Total Teaching Load "P"	Use Factor "X"	Use Factor "P"
A	Classroom 60	340	402	1,484	148	-	1,632	1,417	113%	98%
	Science Laboratory 30	308	114	1,688	169	300	2,157	1,056	149%	73%
	Drawing Office 30	72	52	496	50	300	846	746	58%	51%
	Teaching Workshop 30	72	96	672	67	300	1,039	939	72%	65%
B	Field Laboratory 15	-	-	-	-	-	-	807	-	-
	Demonstration Yard 15	-	-	-	-	-	-	801	-	-
C	Productive Units 15	-	-	-	-	-	-	1,899	-	-
D	General Farm Area 15	238	236	3,792	-	-	-	(2,832)	-	-
	Projects 15	72	182	2,032	-	-	-	-	-	-
	Tutorial Room 15	-	-	-	-	-	1,132	1,082	78%	75%

Notes: 1. It is suggested that two classrooms (at 57 per cent usage rate) and two science laboratories (at 75 per cent usage rate) will be required under Scheme "X".

2. Approach "P" is the suggested method of using production units for teaching purposes (see Table II), whereas Approach "X" is based on the traditional classroom/laboratory method.

TABLE IV
COMPARATIVE SPACE REQUIREMENTS FOR FARM BUILDINGS

Function	Typical Farm Sq.M.	Proposed Farm Sq.M.
Semi-covered yard 50 cows	300	260
10 calf pens + 3 calving boxes + 2 isolation boxes (including circulation)	80	105
2 bull pens	50	50
Milking parlour (including collecting yard and holding box)	70	90
Dairy production unit	75	30
Services	-	15
Farm classroom	-	70
Shelter for: 6 working bulls) 4 mules) 2 riding horses)	150	125
Sheep pens for: 50 sheep) 15 ewes) 2 rams)	85	85
Poultry: 3,000 chickens	300	400
Silos and food storage	200	200
Implement store	750	700
Nursery	45	60
Farm management	80	80
Total	2,185	2,270

ANNEX A

FARM SCHEDULE

Dry topics: 100 hectares - irrigated:-

20 hectares lucerne/green fodder
40 hectares grain
20 hectares vegetables/fruit
20 hectares miscellaneous, fallow, etc.

A. DAIRY: 50 cow herd

Zero grazing, to be fed out fodder daily

Followers

2 bulls
25 young stock, 0-24 months

Buildings Required

Semi-covered yard for 50 cows
Semi-covered yard for 15 young stock
10 calf pens
2 bull pens
3 calving boxes
2 isolation boxes
Milking parlour (3 cows in line)
Dairy-milkroom, veterinary store, etc.
Sprayrace

B. OTHER LARGE ANIMALS:

6 working bulls
4 mules
2 riding horses

Buildings Required

12 loose boxes

C. SHEEP: 50 sheep

Buildings Required

Pens for 2 rams

Night pen for 50 sheep with lamb creep and pen
for 50 lambs
Sheep will graze fallow, etc., during daytime

D. POULTRY:

1,000 laying hens in batteries
500 broilers in deep litter
500 growers
1,000 chicks (for restocking and sale)

Buildings Required

Battery houses
Deep litter houses
Brooder room for 1,000 chicks
Incubator room (1,000 capacity)
Egg store for 1 week's production = 4,500 eggs
Equipment store

E. STORAGE:

1. Central Food Store and Grinding Mill

Capacity for storage: Grain silos - 125 tons
Processed food - 9 tons in sacks

2. Fodder Storage

Capacity for storage: Say, storage for 50 tons of
barley straw

3. Fertilizer Storage

Capacity for storage: 15 tons in sacks

4. Feed Storage

Capacity for storage: 3 tons

5. Dung Storage

Capacity for storage: 60 tons (3 months' stock)

F. FARM MACHINERY AND EQUIPMENT:

4 tractors	4 harrows/tillers various types
1 combine	2 weeders
4 dish ploughs	1 bailer
2 ridgers	2 earth scraper blades
1 manure spreader	1 leveller

1 earth scoop	1 buck rake
2 trailers 4-wheels	1 sub-soiler
1 trailer 2-wheels	1 mobile irrigation pump
1 rotavator	1 lorry
1 sprayer	1 bus
2 rotary mowers	1 land rover
1 forage harvester	
2 seed drills	

G. NURSERY: Shade house
 Pot and tool store

H. FARM MANAGEMENT:

- a) Office for Manager
- b) Office for records
- c) Storage space for hand tools, sacks, etc.
- d) Storage space for pesticides and herbicides, hand sprayers, etc.

ANNEX B

FARM SCHEDULE

LIST OF DRAWINGS

Scale

A. DAIRY

A1.	-	General layout showing stables, dairy and goods storage	2.5 mm./pm.
A2.	-	Plan of semi-covered yard	0.5 cm./pm.
A3.	-	Detail of semi-covered yard	1.0 cm./pm.
A4.	-	Plan of calves pen	2.0 cm./pm.
A5.	-	Plan of bull pen	2.0 cm./pm.
A6.	-	Plan of farm classroom	1.0 cm./pm.
A7.	-	Plan of the milk parlour and dairy laboratory	1.0 cm./pm.
A8.	-	Elevation of semi-covered yard	0.5 cm./pm.

B. LARGE ANIMALS

B1.	-	Plan of shelter for large animals and sheep pen	1.0 cm./pm.
-----	---	---	-------------

C. POULTRY

C1.	-	Plan of poultry house	0.5 cm./pm.
-----	---	-----------------------	-------------

D. STORAGE

D1.	-	Plan of food store	0.5 cm./pm.
-----	---	--------------------	-------------

E. FARM MACHINERY

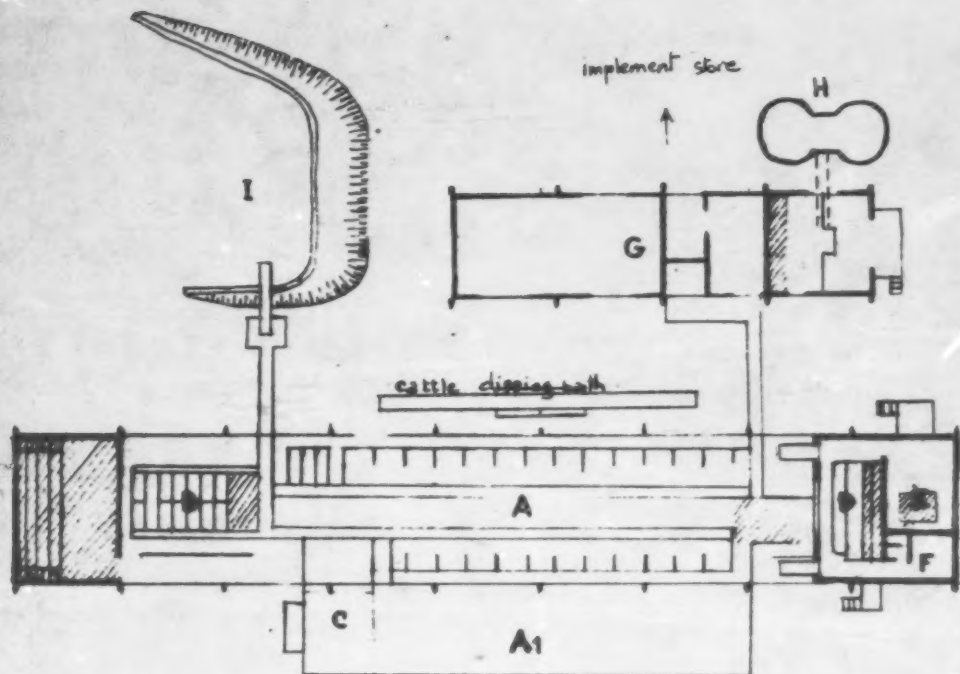
E1.	-	Plan of implement shed	0.5 cm./pm.
-----	---	------------------------	-------------

DRAWING A1

SCALE : 2.5 M/M per M.

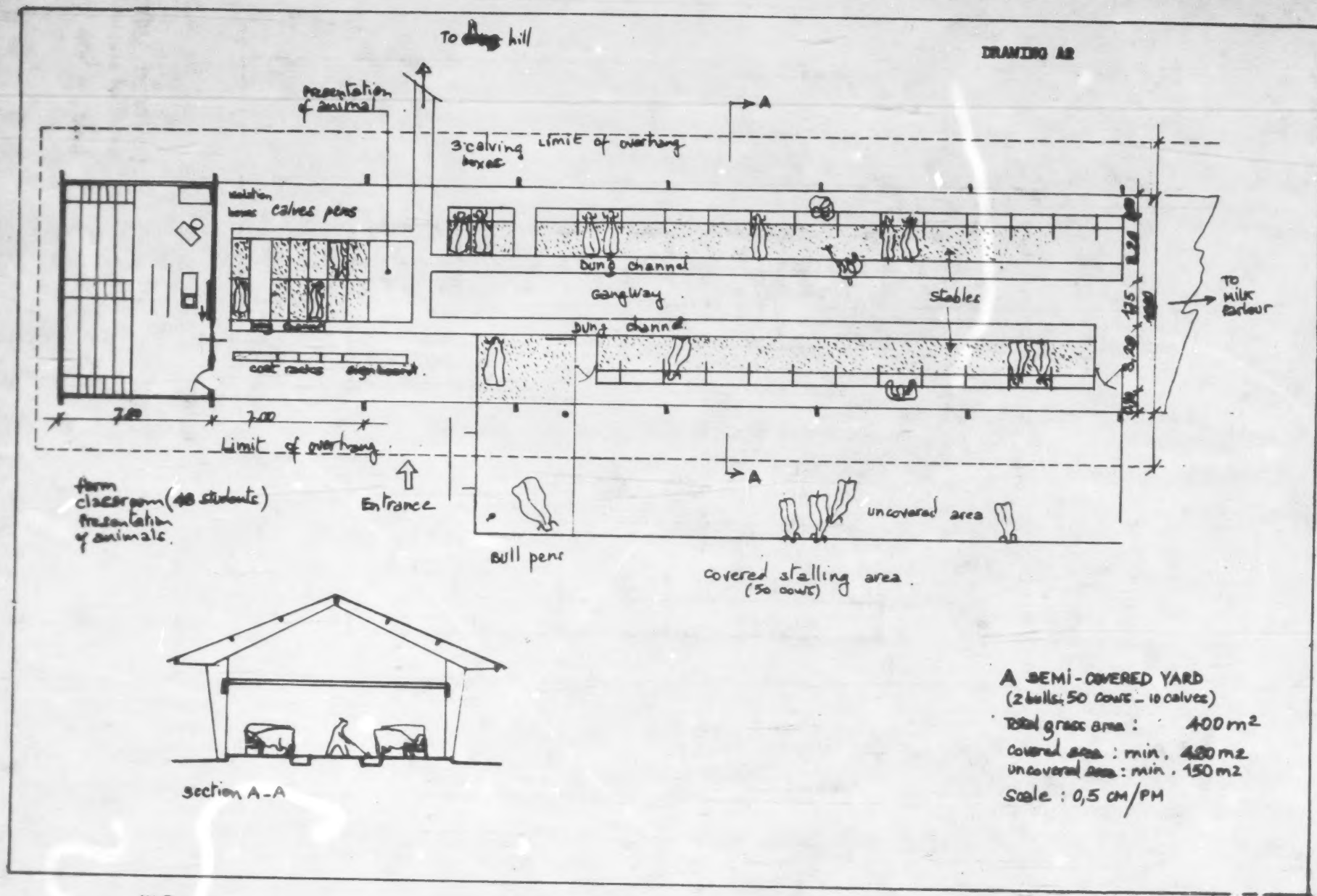
For details see Drawings A2 - A8

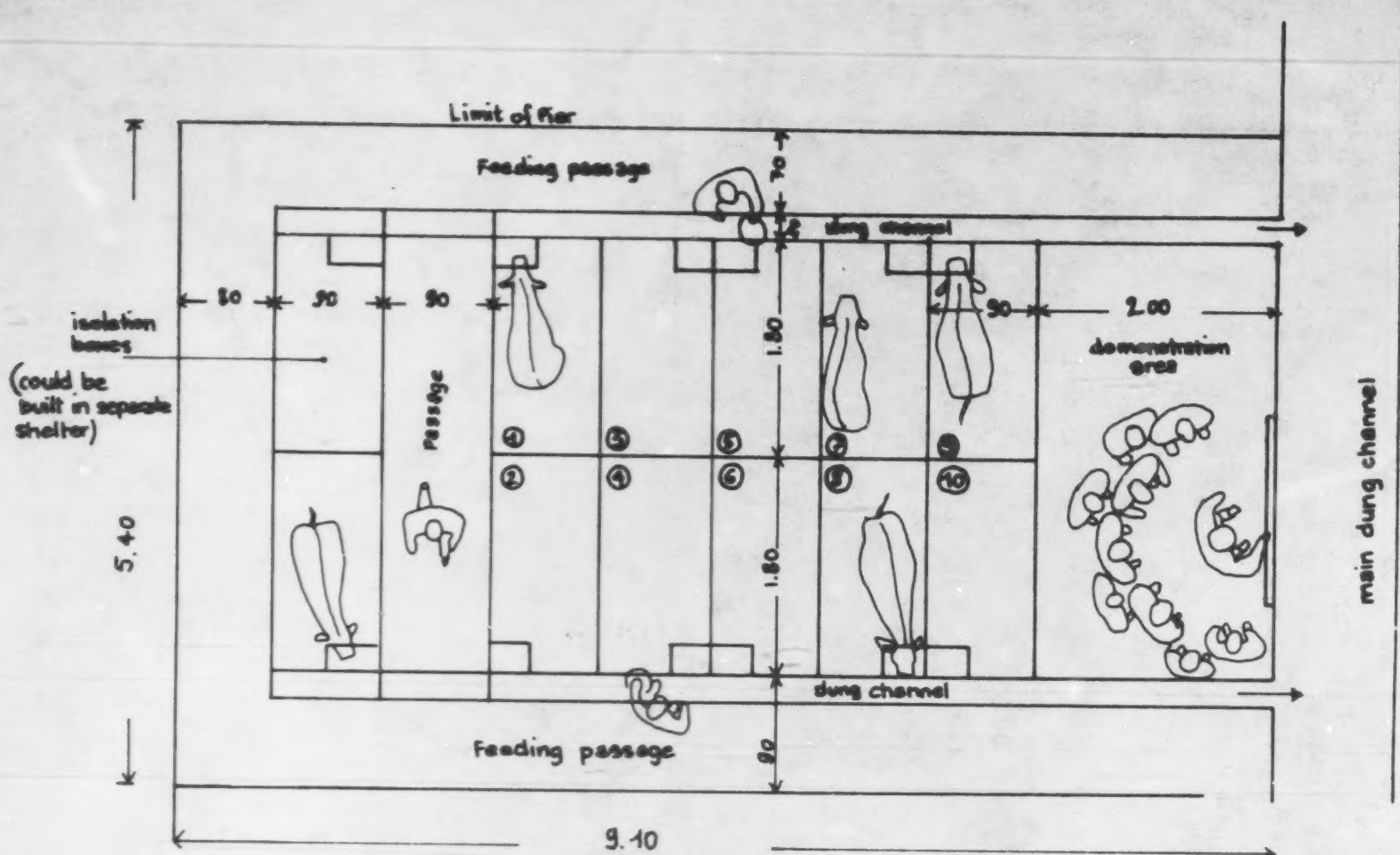
 Teaching & demonstration areas



PLAN OF STABLES, MILK PARLOUR AND STORES.

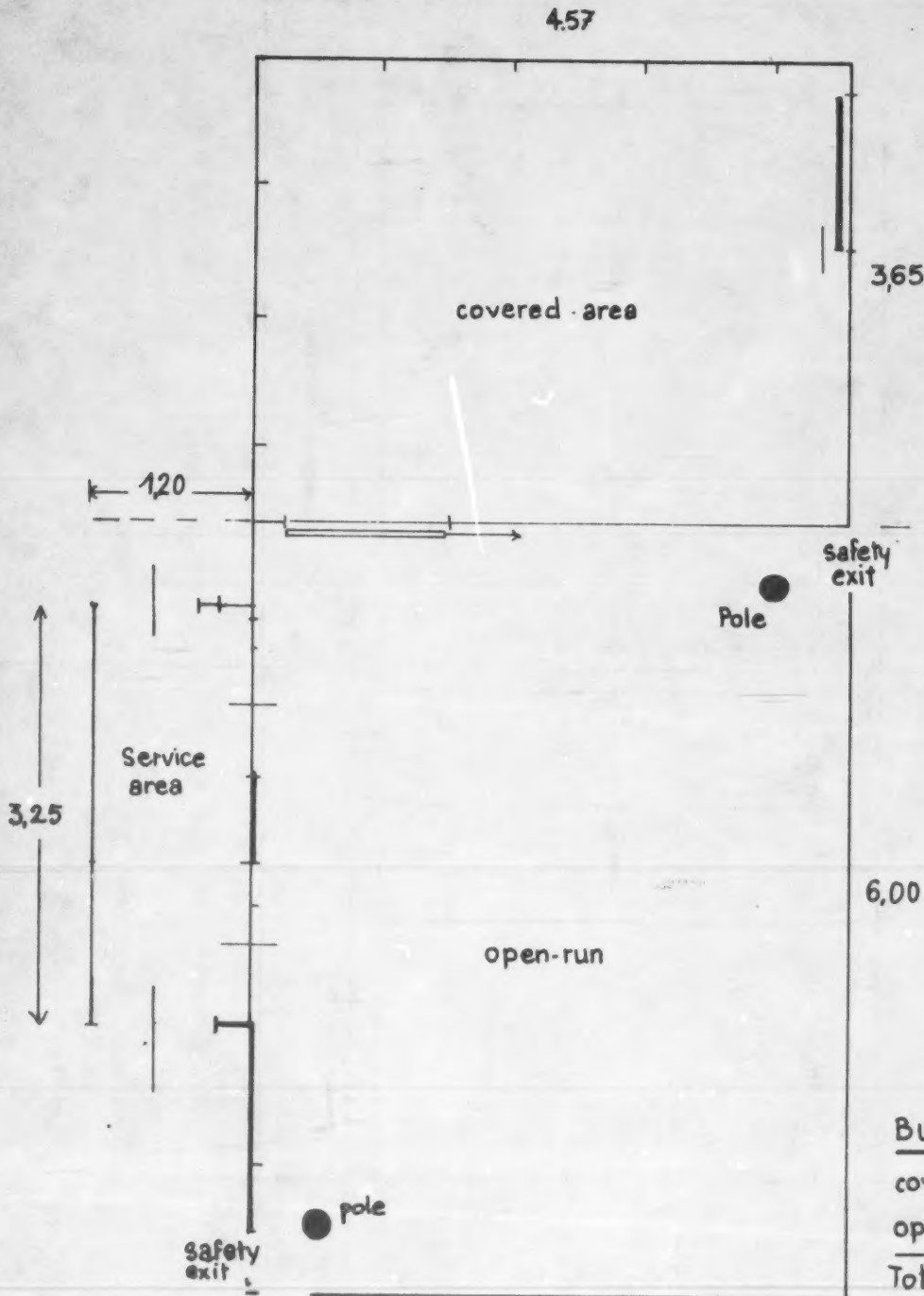
- A covered yard 50 cows
- A1 open yard
- B calves pens 10 calves
- C Bull pen 2 bulls
- D Milking parlour
- E Dairy room
- F Watchman
- G stores
- H grain silos
- I dung storage





calves pen (10 calves)
 total useable area: 49.15 m²
 scale: 2cm/m.

- 73 -



Bull pen

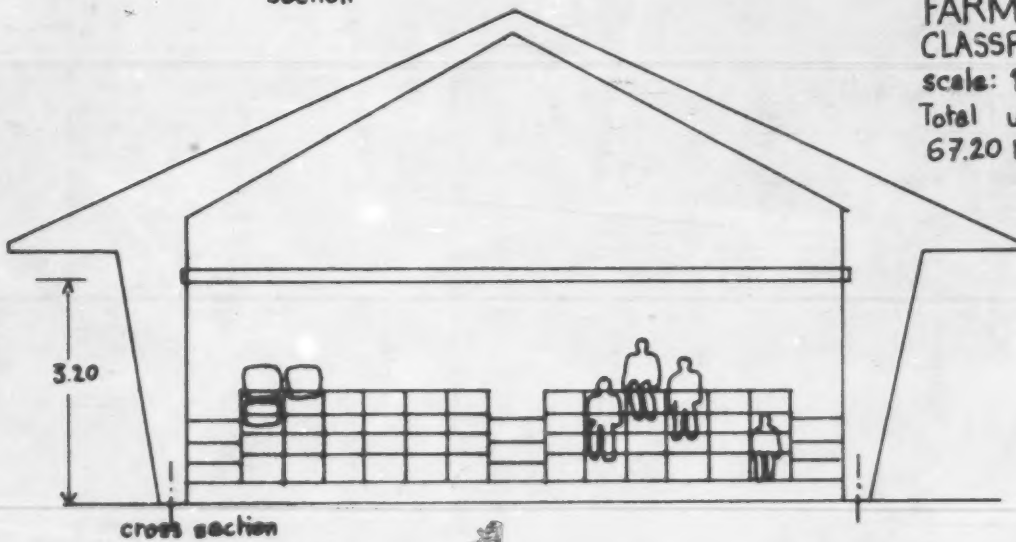
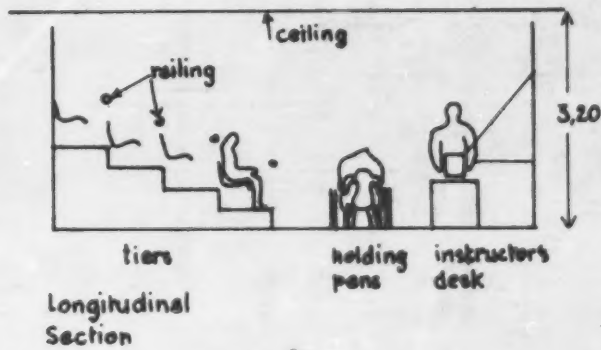
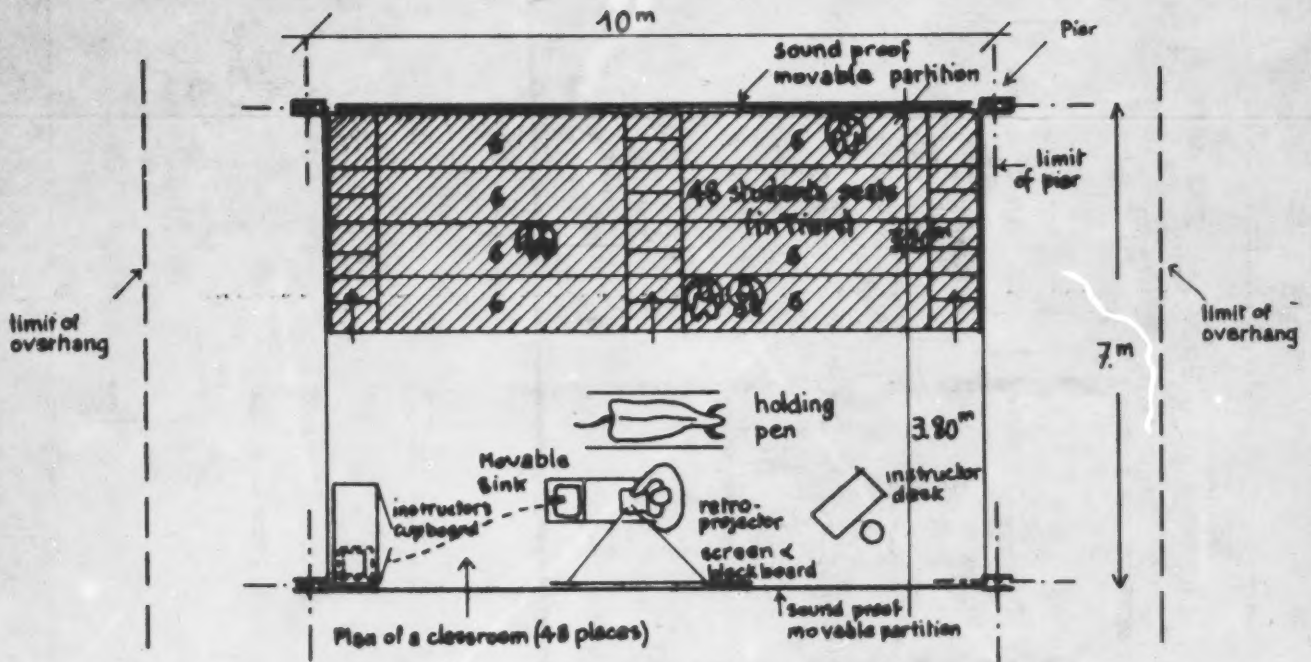
covered area: 16,70

open run : 27,50

Total per animal 44,20 m²

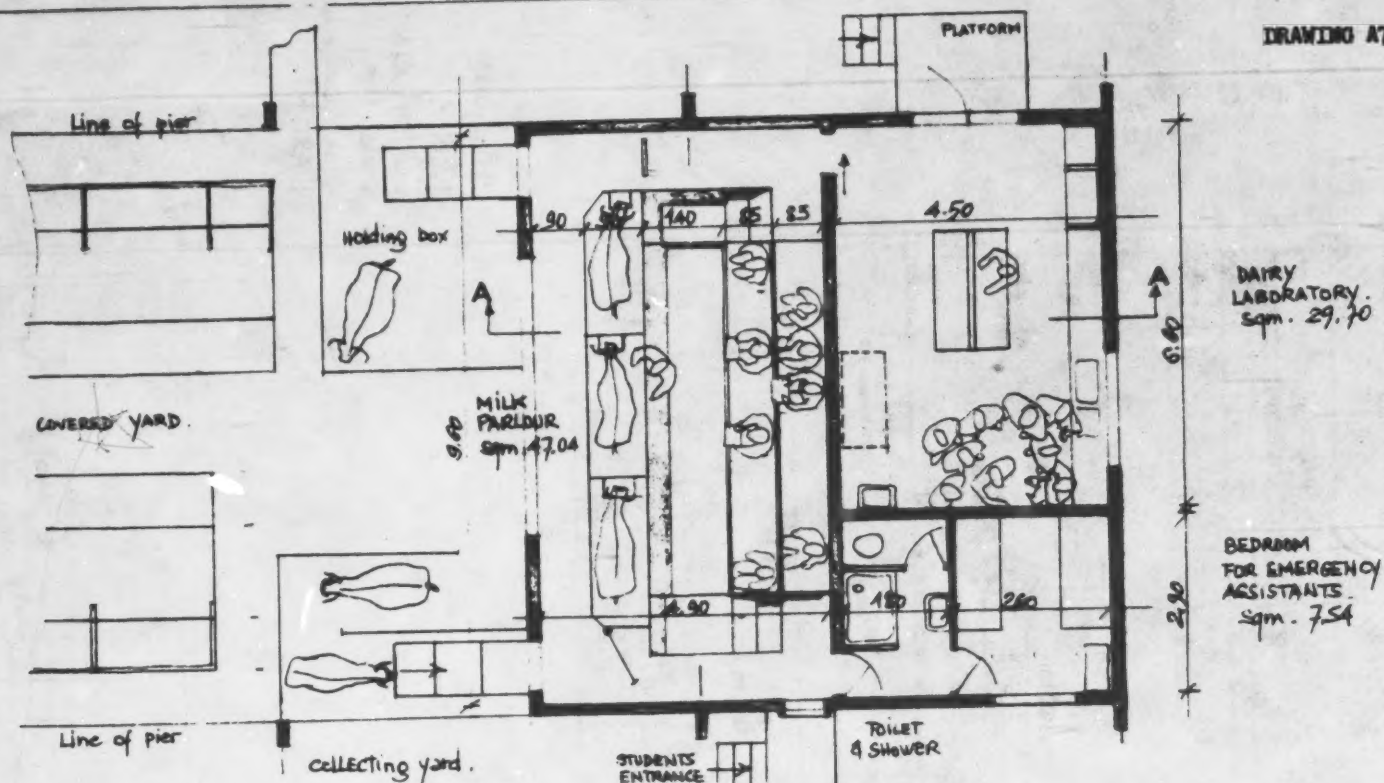
scale: 2 cm/p.m.

1/50th



48 students
FARM
CLASSROOM
scale: 1 cm p.m.
Total usable area.
67.20 M²

DRAWING A7

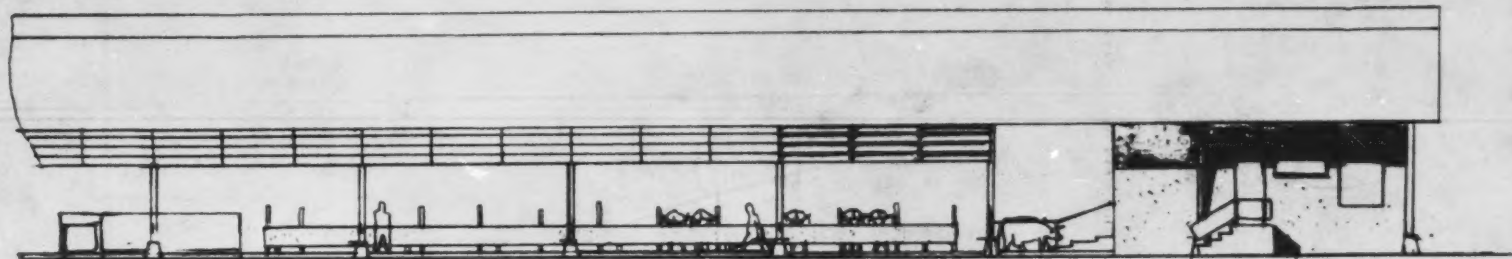


SECTION A-A

MILK PARLOUR

DAIRY LAB.

MILKING PARLOUR
& DAIRY.
SCALE: 1CM. PM.

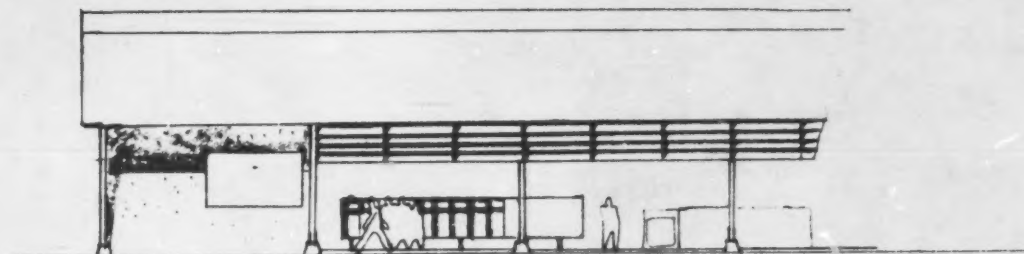


Bull pen.

stables . (50 cows)

collecting
yard .

MILK PARLOUR



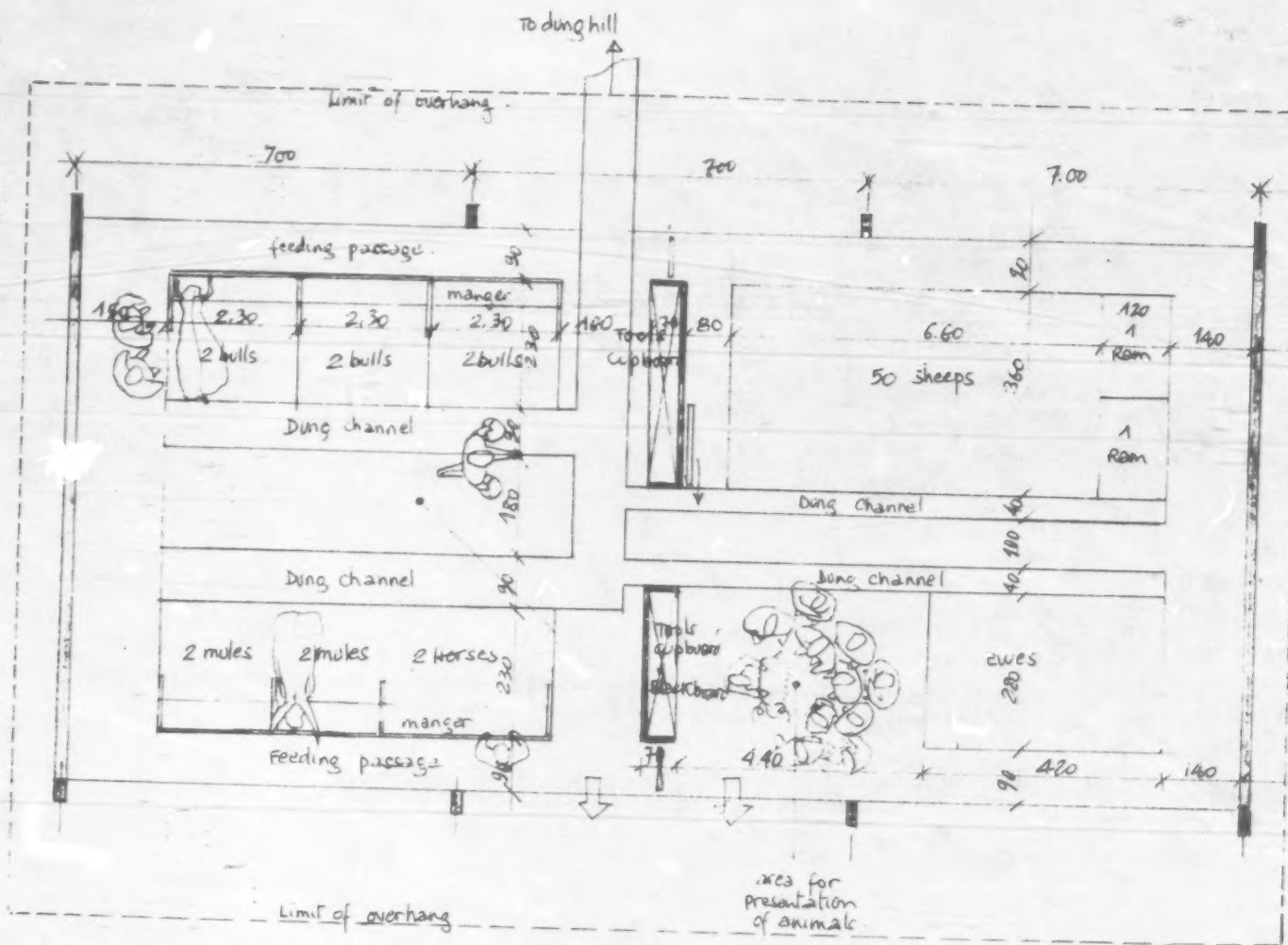
farm
classroom
48 students

coat racks
access to classroom

Bull pen .

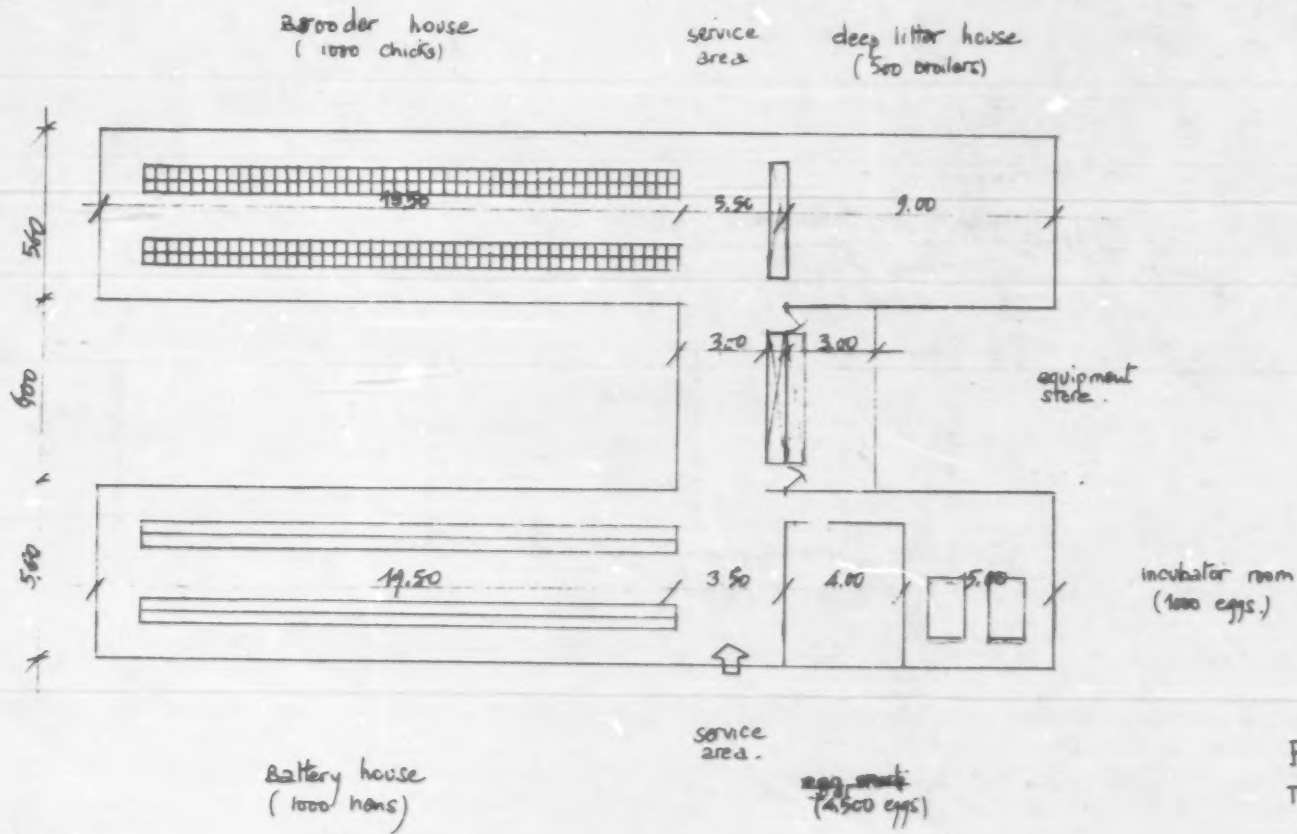
COVERED YARD .
ELEVATION
SCALE : 0.5 CM / PM .

DRAWING B1



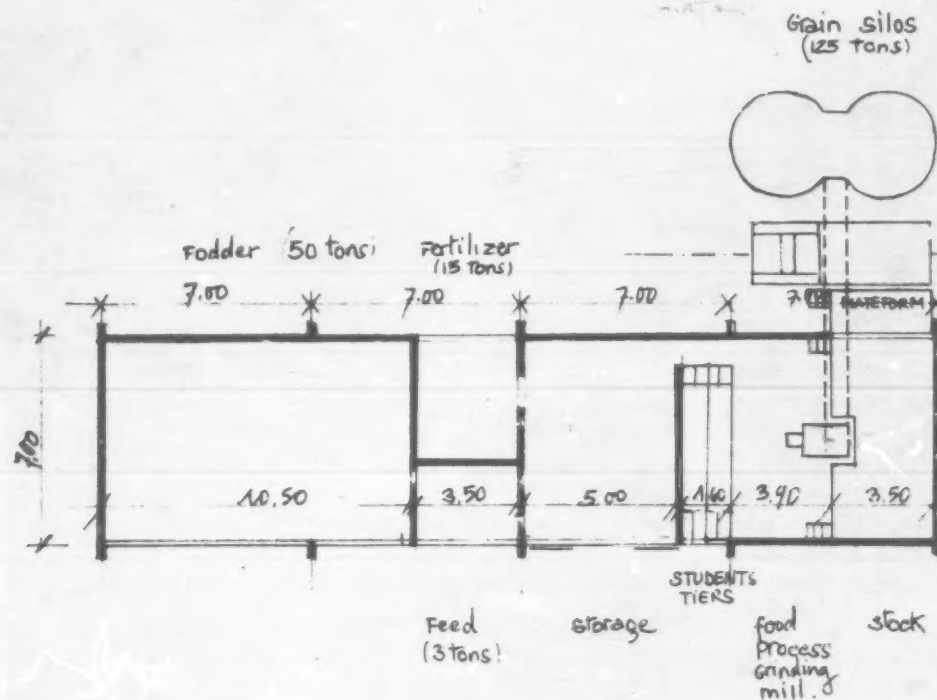
SHELTER FOR LARGE
ANIMALS & SHEEP
PENS.
Total area : 9m
Scale : 1:1

DRAWING C1

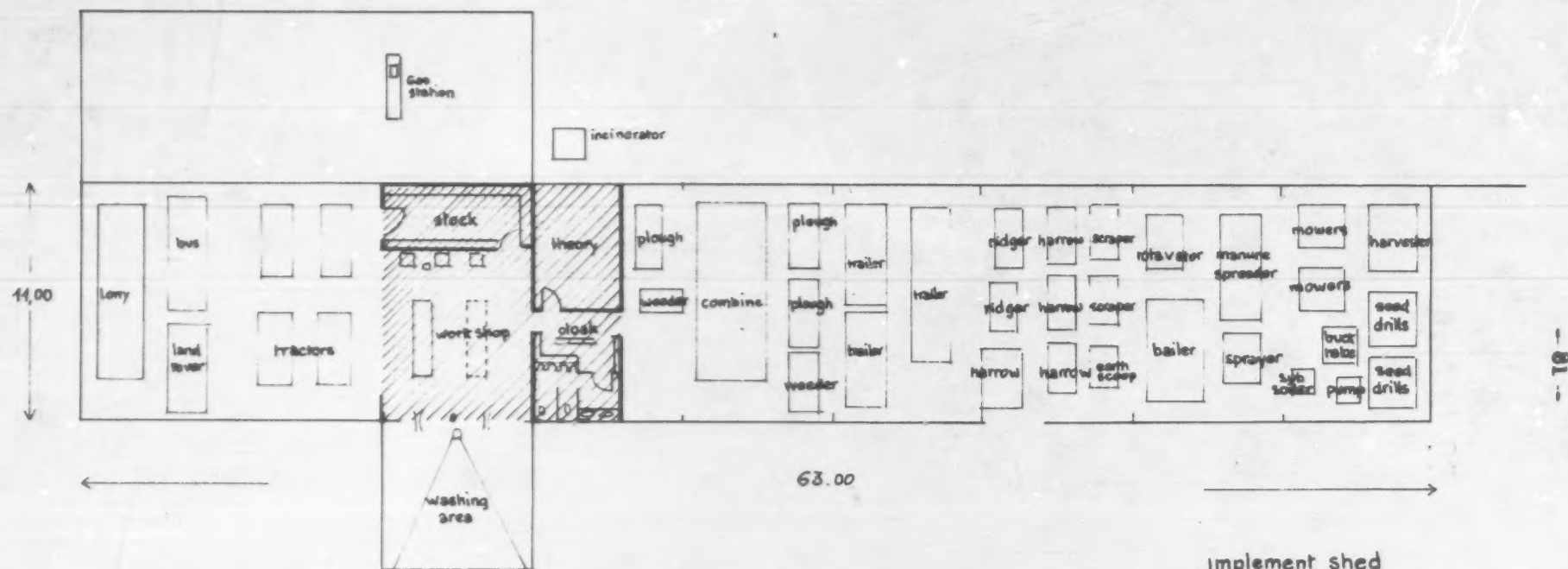


Poultry House.
Total area : 397.40 Sqm
Scale : 0.5 cm / m

DRAWING DL



STORAGE .
Total area: 196 sqm.
SCALE: 0,5 CM / PM

implement shedtotal usable area : 693 m²

scale: 5 m = 1 cm.

3375
8-45

4-2

WORKSHOPS FOR VOCATIONAL EDUCATION
IN COMPREHENSIVE SCHOOLS

by

H. Baritsch

WORKSHOPS FOR VOCATIONAL EDUCATION
IN COMPREHENSIVE SCHOOLS

Outlined below are schematic sketches for combined workshops, incorporating different sections which are normally provided in separated workshops. The combined workshops are intended for multiple group use, i.e. more than one standard size student group may be working in them, with student rotation between different work places.

The proposed multiple-group usage could, perhaps, help avoid a dilemma which so often confronts technical educators: namely the virtual impossibility of providing sufficient equipment so that all students are able to work at one and the same time, e.g. milling, or surface grinding. Multiple-group usage demands that instructors are willing to rotate between different work places and that they have a flexible approach to the organization of shop work.

If these conditions can be met, considerable space and equipment economies could be effected. The savings could be utilized to provide a wider, more sophisticated range of equipment for the larger shop units, where there would be a sufficiently high utilization of the more expensive items of equipment.

The examples given refer to student groups of 40 students each. Naturally they would require more than one instructor. The equipment items mentioned are, of course, only a sample of the main items.

The proposed principle would make school workshops more similar to real-life workshops than is normally the case at the moment, and thus would have a beneficial educational effect.

MAJOR EQUIPMENT ITEMS FOR MULTI-GROUP WORKSHOPS

Workshop/Section/Items	No. of Items per Workshop		
	1 Group	2 Groups	3 Groups
<u>Metal Workshop</u>			
<u>Bench Work</u>			
Sets of hand tools, and bench work place	20	40	40
Shop tools (sets)	2	4	4
<u>Auto-Mechanics</u>			
Sets of hand tools (for groups of 5 students)	2	2	2
Shop tools (e.g. lifters, testers, etc.)	1	1	1
<u>Welding and Forging</u>			
Arc welding sets	3	3	5
Gas welding sets	3	3	5
Field forges with accessories	2	2	3
Anvils with hand tools	4	4	6
Spot welder, hand	-	1	2
Plastic welder set	1	2	2
Shears	1	1	1
Oxyacetylene cutting machine	-	-	-
Heat treatment furnace	-	1	1
<u>Sheet Metal Work</u>			
Bending and folding machine, hand	1	1	1
Rolling machine, hand	1	1	1
Guillotine, hand	1	1	1
Punching machine, hand	-	1	1
Conical rolling machine, hand	-	-	-
Cylindrical forming machine, hand	-	1	1
Hand tools, sets	2	3	4
Working tables (for number of students)	3	5	8
<u>Machine Shop</u>			
Student lathe + accessories	3	5	6
Machinist lathe + accessories	-	1	1
Lathe with copying attachment, accessories	-	-	1
Milling machine + accessories	2	2	3
Shaping machine	2	2	3
Surface grinding machine	-	-	1
Marking and measuring tools, sets	2	3	4
Drill presses, bench type	1	1	2
Drill presses, floor type	-	1	1
Shop tools (tap and die, etc.), sets	2	3	4

MAJOR EQUIPMENT ITEMS FOR MULTI-GROUP WORKSHOPS (Contd.)

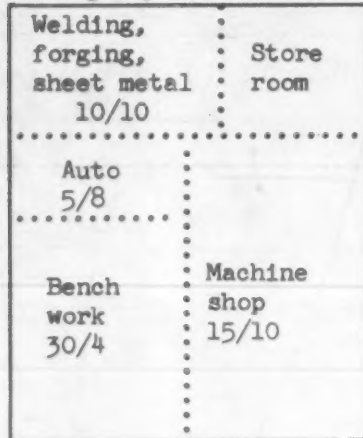
Workshop/Section/Items	No. of Items per Workshop		
	1 Group	2 Groups	3 Groups
<u>Electricity and Electronics</u>			
<u>Residential Wiring</u>			
Work cubicles for 2 trainees each	10	10	10
Hand tool sets (1 per cubicle)	10	10	10
<u>Work and Test Benches</u>			
Bench with measuring instruments for 3 students	7	10	13
Hand tools and instruments, sets	7	10	13
Set of shop tools and instruments	2	3	4
<u>Motors, Generators and Coil Winding</u>			
Test benches	2	3	4
Motors and generators	4	6	8
Coil winding equipment, set	1	1	2
Transformer	1	1	1
Shop instruments and tools, set	3	4	5
<u>Appliances Repair</u>			
Items of appliances	-	2	4
Bench work places with tooling	-	5	8
<u>Refrigeration</u>			
Condenser with insulated cubicle, tooling and testing set	-	-	1
<u>Electronics</u>			
Laboratory benches with instrumentation	10	20	30
Component sets and chassis	10	20	30
Laboratory instrumentation, sets	1	2	3
<u>Woodwork</u>			
<u>Bench Work</u>			
Work benches for 2 students, with tooling	20	40	
Shop tools, sets	3	5	
<u>Machines^{1/}</u>			
Circular saw	1	1	
Band saw	1	1	
Wood milling machine	1	1	
Woodworking lathe	2	2	
Drill press	1	1	
Sanders, hand	2	4	
Belt sander	-	2	
Compressor and spray painting set	1	1	

1/ Machines are mainly for preparation of student work by instructional staff.

METAL WORKSHOPS

Utilisation: In-shop rotation

For 1 group of 40 students



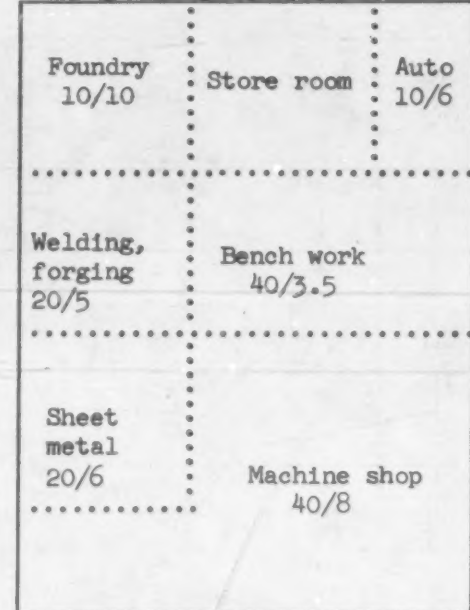
60 work places, total
410 sq.m. = 6.8 sq.m.
per work place

For 2 groups of 40 = 80 students



100 work places, total 640 sq.m.
= 6.4 sq. per work place

For 3 groups of 40 = 120 students



140 work places, total 840 sq.m.
= 6.0 sq.m. per work place

Note: Sketches are not to scale.

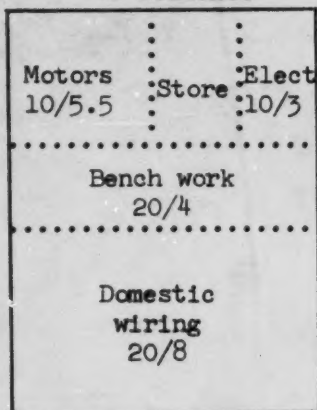
Figure before / = number of work places in section.

Figure after / = sq.m. per work place in section.

ELECTRICITY AND ELECTRONICS WORKSHOPS

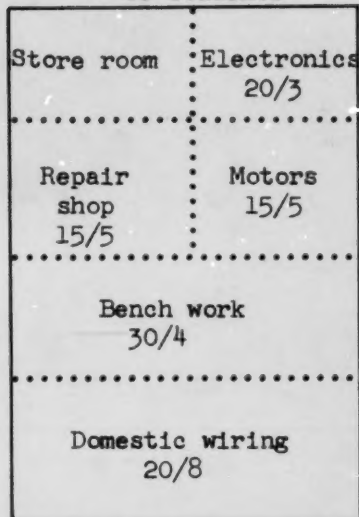
Utilisation: In-shop rotation

For 1 group of
40 students



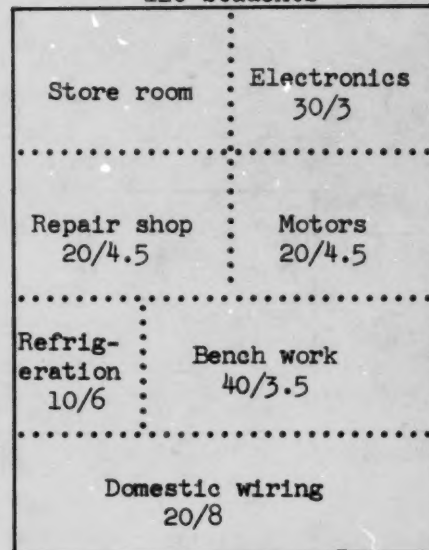
60 work places, total
325 sq.m. = 5.4 sq.m.
per place

For 2 groups of 40
= 80 students



100 work places, total
490 sq.m. = 4.9 sq.m.
per place

For 3 groups of 40
= 120 students



140 work places, total
630 sq.m. = 4.5 sq.m. per
place

Note: Sketches are not to scale.

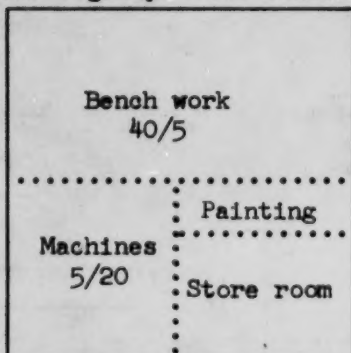
Figure before / = number of work places in section.

Figure after / = sq.m. per work place in section.

WOODWORK SHOPS

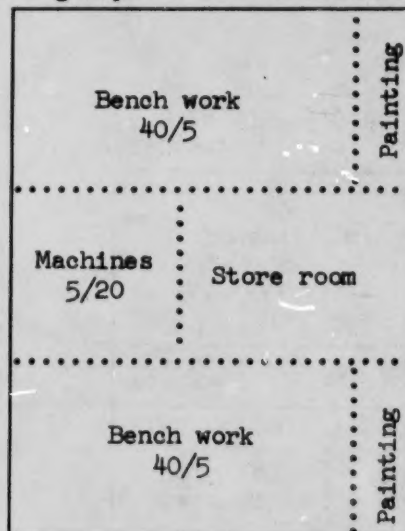
Utilisation: Student bench work, woodworking machines
mainly for use by instructional staff for preparation

For 1 group of 40 students



40 work places, total
300 sq.m. = 7.5 sq.m.
per place

For 2 groups of 40 = 80 students



80 work places, total
500 sq.m. = 6.25 sq.m. per
place

Note: Sketches are not to scale.

Figure before / = number of work places in section.

Figure after / = sq.m. per work place in section.

TECHNICAL EDUCATION AND VOCATIONAL TRAINING IN THE USSR

by

G.F. Dolbnin

TECHNICAL EDUCATION AND VOCATIONAL TRAINING IN THE USSR

Introduction

To understand better the vocational training and technical education in the USSR it is appropriate to start with a brief review of the general education system in that country (see Appendix 1).

The first link in the chain is the pre-school establishments, day nurseries and kindergartens, or combined day nursery/kindergartens, which (if the parents so choose) children attend from the age of 2 months to 6 years.

Children attend secondary school from 7 to 17 years of age. The secondary school is divided into three stages: elementary (grades 1-3), incomplete secondary (grades 4-8), and complete secondary (grades 9-10).

At present approximately 90 per cent of all students who graduate from the eight-year school go on to receive a complete secondary education, and it is expected that the number will increase each year. The transition to universal general and specialized secondary education for all students is of great importance for solving the basic problems of economic, social and cultural development of the country.

There are three main types of secondary schools:

- (1) general education - all of which include polytechnic education, and provide for the completion of general education in the sciences and humanities. The polytechnical element gives an opportunity for students to master a profession quickly after graduation (grades 1-10);
- (11) specialized - which prepare technician specialists of middle-level qualification (grades 9-12);
- (111) vocational - which train skilled workers (grades 9-12).

Upon graduating from the eighth grade the great majority of students go on to study in the higher (ninth and tenth) grades of general education schools. About 10 to 12 per cent of all students continue their studies in specialized secondary schools, where, in the course of three or four years they receive a general secondary education and a profession. Over 15 per cent of all students continue their studies in vocational schools, which provide skilled workers for all branches of the economy. The courses of study in vocational schools vary from one to three years. The number of these schools providing three-year courses of study with both general secondary education and professional training is increasing, and by 1975 from 300 to 400 thousand students of both sexes will be enrolled in them.

Young people who graduate from vocational schools with shorter terms of study (one to two years), as well as persons who are employed but who were unable to complete school, can enrol in complete secondary evening and correspondence

schools. These have three grades instead of two as in the usual schools. The network of evening and part-time day vocational schools provides an opportunity for working youth to improve their skills.

Higher education is available in universities and in university-level establishments, with periods of study varying from four to six years. To be eligible for admission, candidates must have a certificate of (full) secondary education (10 grades), or a diploma of completion of specialized secondary education or vocational school with (full) secondary education (9 to 12 grades). This level of education is also provided both externally and by evening study.

Thus the characteristic features of the Soviet educational system are the unity and continuity of all stages of education. There is a single, nation-wide system of elementary, secondary, vocational and specialized secondary schools, and university-level educational establishments. Advancement to the next, higher stage of education is possible from all schools. Those who graduate from vocational or specialized secondary schools with general secondary education and wish to continue their studies in a day university-level institution, may enrol after having gained three years' working experience in their field. Each year the first 5 per cent of graduates from specialized and vocational secondary schools are recommended for entry to university-level institutions without having to take the entrance examinations.

All stages of education in the USSR are free, and are equally available to both sexes. In addition, in specialized secondary schools and higher institutions up to 80 per cent of the students receive financial assistance (stipends) from the State. The availability of long and short-term plans for manpower requirements makes it possible to guarantee graduates from the educational establishments jobs in their own field.

One of the important functions of the Soviet State is educational management. The All-Union laws on education serve as the basis for the work of all State educational bodies. Educational management of general schools is implemented by the Ministry of Education of the USSR and its subordinate organs (Ministries of Union Republics, region, city and district departments).

The educational management of all the universities is carried out by the Ministry of Higher and Specialized Secondary Education, which has counterparts in the Republics. All the other higher and specialized secondary establishments are operated, financed and maintained by the individual ministries in charge of the various branches of the economy. Curricula, syllabuses, textbooks, instructional methods, etc., are supervised by the Ministry of Higher and Specialized Secondary Education and its counterparts in the Republics.

The training of skilled workers at vocational schools is controlled by the State Committee of the USSR for Vocational Training, its subordinate organs (Republic committees and region departments for vocational training) and branch ministries concerned. The State Committee is responsible for the overall planning of training of skilled workers, the creation of curricula, syllabuses, textbooks, teaching aids, instruction methods, training of industrial instructors for vocational schools and the up-grading of staff. It also is responsible for drawing up standard programmes for on-the-job training, the up-grading of the skills of workers and the supervision of training methods for workers being trained on-the-job.

Administrative supervision, financing, and control of vocational schools is entrusted to committees and departments within each Republic or region. These committees and departments, within the framework of the overall plans and policies fixed by the State Committee of the USSR, decide enrolment quotas, specific programmes and staffing problems. The planning of training for workers for each branch of the economy, construction of new vocational schools, operation, financing, on-the-job training and up-grading training in industry directly, is under the responsibility of the branch ministries.

Appendix 2 shows the general structure of the educational management in the USSR.

GENERAL SCHOOLS AND POLYTECHNIC EDUCATION

The reconstruction and new development of the whole system of education in Russia was started after the October Revolution (1917). In the difficult years of civil war, economic reconstruction and the transition to industrialization (1917-1928), when austerity was the order of the day, new schools were being opened throughout the country even in the most remote regions. The necessary foundations were being created for establishing universal elementary education and for the development of a secondary school system. In addition a great nationwide campaign was launched to teach illiterate adults.

In 1930, a law on universal compulsory elementary education was passed which stipulated that all children who had reached the age of 8 years by 1 September 1930 were to be enrolled in four-year elementary schools. This goal was achieved by 1933.

The rapid economic, social and cultural development during the first and second five-year plans (1928-1937) led to the establishment of general education schools. The number of secondary schools increased both in the towns and the country. A network of technical schools and university-level establishments was also developed.

Universal seven-year compulsory education was introduced mainly in the cities, by the late 1930's, with considerable progress also achieved in the rural areas towards this aim. Through the joint efforts of State and voluntary organizations, illiteracy among the adult population was practically eliminated, with 60 million illiterates and semi-literates having learned to read and write.

The Third Five-Year Plan (1938-1942) visualized the achievement of compulsory secondary education in the cities, and seven-year education in rural areas. The Second World War prevented these goals from being reached. During the war, some 82,000 schools and 334 higher education institutions were destroyed. Large numbers of teachers were killed, and thousands of teenagers left school to work in the factories. In the post-war period, the school network was rebuilt and rapid educational development took place.

In 1950 the transition to seven-year education on a nation-wide scale began, and was almost completely achieved by 1952. The next major step towards establishing universal secondary (ten-year) education was the introduction, in 1959, of universal compulsory eight-year education, which was practically effected

by the end of 1961. There are now about 200,000 general education schools in the USSR, with a total enrolment of more than 50 million students. Appendix 3 presents some data concerning the development of general education for the period 1922-1970.

Students in Soviet Union schools are taught in one of the 57 languages of the USSR. Over 40 nationalities have created their own written language, and every citizen has the right to speak that of his choice, and to educate his children in that language. In the Republics' schools, Russian is taught as a free-choice, second language. This helps the mutual exchange of experience and to give each national group and people access to the cultural heritage of the other peoples of the USSR. In practice, Russian has become the language for international communication among the peoples of the USSR.

While the elementary, incomplete and complete secondary schools provide a unified curriculum for students in town and country, this does not mean that the curricula and the term of study at the general secondary schools throughout the country coincide completely. Each Republic has its own curriculum for such subjects as native language and literature, Russian as a second language in the national schools, and the history and geography of the given Republic. Each Republic, in agreement with the USSR Government, has the right to establish its own terms of study^{1/}. All educational establishments in the USSR are co-educational.

One of the characteristic features of the Soviet educational system is the provision of polytechnic education from the first to the tenth grade of general schools. Its main purpose is to achieve a balanced development of students, and to prepare them for life and practical work activity. Its objectives are:

- to provide basic science training regarding sources of energy, basic technology and modern production organization;
- to disseminate knowledge of developments in the various branches of industry and agriculture;
- to provide the students with general practical skills and abilities; and
- to develop the students' interest and aptitudes for technical work.

Polytechnic education, in the broad sense of this term, is given to students through the study of the basic sciences, general technical education and work education.

The main emphasis for the basic sciences syllabuses is to establish the proper relationship between classical and basic scientific knowledge and new scientific achievements, and to introduce general technical education into this teaching.

^{1/} For example, in the Baltic Republics (Latvia, Estonia and Lithuania) the secondary schools are not ten-year schools as in the other Republics, but eleven-year schools.

General technical education programmes are designed to cover the more common machines and mechanisms encountered in industry and everyday life and scientific research. They also emphasize the basic knowledge of sources of energy, electro-techniques, electronics and elementary knowledge of automation applied to production processes, and the general principles and objectives of the economics of planning and organization of production.

All students from the sixth to eighth grades study mechanical drawing, the courses for which include reading and drawing outlines, technical drawings and modelling from drafts. These assignments are mostly linked to mathematics in the workshops, and are part of polytechnic education.

The polytechnic principle is applied to work education with both theory and practical training, providing the means for the study of the basic elements of production. Work education ensures the acquisition of the following practical skills in technical fields:

- (i) knowledge of and some skill in handling the more important hand tools used in different types of work;
- (ii) ability to read a drawing and make a sketch, and mark out on the material the principal shapes and dimensions;
- (iii) ability to "set up" and operate common machine tools;
- (iv) ability to dismantle and re-assemble simple pieces of machinery;
- (v) ability to install and start an internal combustion engine, an electric motor, pump, compressor and similar small power tools;
- (vi) ability to carry out the main types of electrical assembly, repair work and the following of a simple wiring diagram;
- (vii) knowledge of how to use the main measuring and control instruments.

Work education is divided into three compulsory stages; manual lessons in grades 1 to 3; work education in grades 4 to 8, and polytechnic practice in grades 9 and 10. Classes are held in the school workshop or outdoors in the school garden. Students master the fundamentals of carpentry and metalwork, and work on various projects in electricity. Rural schools add simple farming methods. Students of the seventh grade are taught to use wood and metal lathes; eighth grade students study metal-cutting machines and the working of internal combustion engines and electric motors. They also study the fundamentals of technology. Emphasis is placed on simple designing and the ability to read blueprints.

Work education is closely connected with the teaching of the basic sciences. This approach familiarises students with the application of scientific achievements to the solution of practical problems, and helps them examine the scientific basis of techniques and technology. Teachers of work education pay great attention to the development of good working habits, and they encourage persistence and independence. The study programme includes excursions to industrial enterprises, films on different production theories, and laboratory experimentation.

None of these courses taught in the seventh and eighth grades provide professional-level skills. However, in the ninth and tenth grades they do provide a basic technological knowledge and skill on a broad basis, and are equivalent to pre-professional training. The two-year courses offer a choice of the following subjects: electro-technology, radio-electronics, metalwork, automobiles, mechanical drawing, applied chemistry, tractors, vegetable gardening, fruit growing, cattle feeding, agro-chemistry, textile printing and typing. The schools choose the subjects they can offer according to their facilities and to the interests of their students.

Wherever possible, students receive actual professional ratings. However, vocational training is optional and can only be conducted by schools with the required facilities (i.e. schools attached to big factories or State and collective farms, where they are provided with the necessary instruments, materials, working places and training personnel). Training is conducted in different trades in accordance with the wishes of the students.

General technical education and work education courses are conducted by teachers and industrial instructors who have graduated from courses at educational institutes, colleges and industrial teacher training colleges. At present, there are 210 educational institutes, about 300 educational colleges and 100 industrial teacher training colleges in the USSR. The polytechnic bias at all these educational establishments applies to all subjects, but is particularly marked in the training of teachers of natural sciences, mathematics and general technical subjects. The special five-year duration industrial, educational faculties train teachers of electrical and mechanical engineering for urban and rural schools.

Polytechnic education in general secondary schools prepares students for life and work, as well as for higher education. It familiarizes them with general scientific principles, modern techniques and technology typical of many branches of modern production. It provides students with basic scientific and general technical knowledge, and with pre-occupational multi-purpose work training, and helps to develop creative thinking about technical and technological processes. Finally, it introduces the students to the idea of socially useful productive work, and gives them the freedom to choose their future profession, while ensuring that this future professional training will be of short duration.

TECHNICAL EDUCATION

In the USSR technical education at the higher and middle levels is provided through higher educational establishments and specialized secondary schools respectively.

Training of Engineers

Russian higher education began in the 18th century. The first attempt to establish this type of education was made in 1727, when the Higher School of Learning of the newly created Academy of Science was set up. By 1913, there were 95 higher educational establishments in Russia.

During the last fifty years the number of higher educational establishments has greatly increased. The table below shows the number of these establishments with enrolments for the period 1922-1970:

	1922/23	1940/41	1950/51	1960/61	1970/71
Number of Higher Educational Establishments	248	817	880	739	805
Enrolment (thousands)	217	812	1,247	2,396	4,579

Within this period great attention was paid to the training of engineers and other specialists for such sectors of the economy as industry, construction, transport, communications and agriculture. The following table shows the enrolment in higher educational establishments for these specializations:

Branch	Enrolment (thousands)				
	1927/28	1940/41	1950/51	1960/61	1970/71
Industry and Construction	41	169	273	873	1,823
Transport and Communications	3	36	48	147	252
Agriculture	21	52	104	247	422

Soviet higher education now embraces a wide range of training for specialists and a large number of establishments for conducting professional training. The location of the institutes has changed. The emphasis is now placed on training specialists in close proximity to their places of future employment, so that the trainee specialists are drawn from the local populations. Thus, simultaneously with the intensive development of industry in the Eastern region of the country (the Urals, Siberia, the Far East and the Central Asian Republic), the network of institutes and other educational establishments has also expanded rapidly.

In 1973 58 universities and 767 regular day higher educational institutes existed in the USSR, of which 247 were for engineering studies. They trained specialists in over 400 professions for all branches of the economy, and had an enrolment of over 4,600,000.

The distinction between a university and an institute lies in the fact that universities usually offer somewhat broader training and instruction in a variety of fields, largely the natural sciences, social sciences and humanities. Institutes provide narrower specialized training primarily in related groups of fields, in one or in closely related areas of professional training such as a given branch of engineering, agriculture or medicine. Furthermore, in the natural science fields universities offer more theoretical and less applied training to students who plan to teach or engage in theoretical research, while institutes give

primarily applied professional education, as is required for specialized professional jobs in industry, agriculture and business. Universities are concerned with many fields of knowledge; institutes tend to concentrate on only one. University training generally requires five to five and a half years, but in some fields it is currently being extended to six years. The average number of university students in 1970 was 503,503.

The institutes are, however, the major source of supply of USSR professional graduates and they account for about 88 per cent of the total number of higher education graduates. At present they offer training in five branches of professional specialization: engineering-industrial; agricultural; socio-economic; health and medicine; and the education and cultural fields.

The table below shows the enrolments in institutes for 1970/71:

Branch	Enrolment (thousands)	%
Engineering and Other Industrial Specializations	2,098	45.8
Agriculture	422	9.3
Socio-Economic Specializations	344	7.5
Health and Medicine	303	6.6
Education and Culture	1,412	30.8
Total	4,579	100.0

The higher educational establishments in the engineering-industrial branch are divided into two groups. One consists of polytechnic institutes, and the other of industrial branch institutes. Polytechnic institutes train engineers in various specialized fields, while branch institutes usually train them in just one. In general, both types of institutes train engineers in a narrow specialization, while the general structure of the training programmes is similar.

The list of specializations offered by the university-level establishments is determined by the State in accordance with the demands of the economy. This list now consists of 294 engineering specializations in the industrial branch which are shown in Appendix 4, while Appendix 5 shows the number of students graduating from higher educational establishments according to specialization for the last twenty years.

At present three basic types of instructional programmes are offered by the higher educational establishments: regular day or full-time study; part-time evening; and part-time, extension-correspondence programmes.

The regular (day) programme of up to forty-two instruction hours a week is more demanding than the part-time evening programme which covers about twenty hours of instruction weekly. Extension-correspondence students work independently or

with infrequent direct contact with their teacher, limited in some fields and institutions to examination sessions. In others, however, more rigorous guidance is provided, with up to twelve hours of contact with teachers (lectures, laboratory and consultation) per week for six or seven months of the year. During the rest of the time, however, the students' activities are guided by printed instructions and regularly scheduled home assignments. In addition, extension-correspondence students perform certain assignments, such as laboratory exercises in regular higher educational establishments.

In addition to these 825 higher day educational establishments, there are 29 evening and correspondence institutes and 1,200 evening and correspondence departments at various universities and institutes with a total enrolment of 2,383,000, offering a choice of 300 professions. These institutes have no age limit and the term of study is one year longer than for day institutes, but must not exceed six years.

A new type of educational establishment known as a plant-technical institute has been added to the range of schools of higher education. A plant-technical institute is an integral part of a large industrial plant, training specialists to a higher educational level, with studies based on a combination of practical work and theory. The advantage of this type of study, as compared with other types of correspondence and evening studies, is that it provides a regular succession of study and work. The working student is thus given an opportunity to learn every work process connected with his future profession in a systematic way.

Students who have completed secondary or specialized secondary education (including vocational secondary school) and who are between the ages of 17 and 35, are eligible for the day departments of institutes and universities. Those who have the same secondary education and are employed, are eligible for enrolment in evening and correspondence university-level establishments, for which there is no age limit.

All applicants (regardless of whether they intend to study in day, evening or correspondence institutes) must pass a compulsory entrance examination in their major subjects (maximum four). There is an examination in Russian and literature (essay), and, in the Republics, in native language and literature. The examination system has produced the most favourable results in choosing applicants who are best prepared and who show the greatest promise.

To raise the general level of education, and to create conditions whereby even more young people become qualified to enter university-level establishments, the Soviet State, in 1969, adopted a resolution entitled "On Organizing Preparatory Departments Affiliated with University-Level Educational Establishments". The best workers, collective farmers and demobilized Soviet Army men who have completed secondary education are enrolled in these departments, and receive a stipend. After completing the eight to ten month course the entrance examinations are taken. Over 20,000 young men and women are now studying at preparatory departments, and their number is expected to increase to 100,000 in the near future.

The majority of students accepted at institutes receive State stipends. There are special higher stipends for a small number of the best students, while out-of-town students are provided with dormitory accommodation. Institutes have

their own social centres, cafeterias, gymnasias, playing grounds, polyclinics and service centres. Students enjoy free medical care, and those who have children may place them in nursery schools and kindergartens free of charge. The trade unions offer students free vacation trips to resorts, spas and hostels.

Modern production techniques demand graduates with a high level of theoretical and practical knowledge. The institutes strive to educate specialists who can think and work creatively, and who are capable of creating new machines, new materials and of improving the existing methods of production.

The curriculum of all institutes is designed by the Ministry of Higher and Specialized Secondary Education, although some of the university-level establishments draw up their own. Among these are Moscow, Leningrad and Saratov universities, Moscow Bauman Higher Technical School, Moscow Power Institute and Leningrad Polytechnic Institute. This makes it possible for these establishments, which have evolved their own scientific schools, to apply their experience gained in teaching. Annex 1 shows the curriculum of the Moscow Power Institute (qualification of electrical engineering, specialization in "automechanics and telemechanics").

Each school year is divided into two semesters, and at the end of each tests and examinations are administered. Furthermore, each student is expected to produce a special independent study paper each year. Laboratory work is an important part of the curriculum. Its aim is to teach students the latest methods of scientific research and experimentation, and to make them familiar with modern equipment and apparatus. The number of hours devoted to laboratory work depends upon the major subject studied, but generally takes about 20 per cent of the students' time.

All engineering programmes at the institutes require industrial practice consisting of at least three periods: "general", "technological" and "pre-diploma". Around 30 per cent of the students' time is spent in industrial practice. For instance, the electrical engineering programme has four weeks of general industrial practice in the fourth term; technological practice eight weeks in the sixth term and six weeks in the eighth term, while pre-diploma practice lasts seventeen weeks in the tenth term.

During general industrial practice students are familiarized with the plant and assigned for a few days at a time to various workshops. During technological practice students familiar with industrial plants or enterprises allied with their field, study industrial processes with detailed attention to the machinery, norms and technology employed. The pre-diploma practice usually consists of an administrative assignment, assistant shop superintendant for example, or another similar position involving decision-making of a minor supervisory nature.

Thus, a student at the institute becomes familiar with all stages of production and with every job from worker to engineer. He gets to know the given enterprise, its equipment, technology, economy, and the organization of the wage system.

Engineering training, as many other fields of professional higher education in the USSR, culminates in the diploma project. This is a completed work, explaining a complex of theoretical, engineering, constructional, accounting,

organizational, economic and research problems. Students spend a full semester on carrying out the diploma project. After completion, it must be defended before a specially appointed board, which not only determines if it is acceptable but also judges its "practical value", i.e. if it can be applied in industry. The combination of past grades, the diploma project and its defence, and the oral examinations, determine the award of the diploma certificate, which states that the student is a trained engineer in a given specialization.

The terms of study of all higher educational establishments adhere to a strict schedule. A set term of study is established (no less than four and not exceeding six and a half years) for each profession, and every student must complete his studies within this period of time. A student may take leave of absence if ill for one year, in all the years of study, and women students in day departments are granted maternity leave in accordance with the general rules which apply to all expectant mothers.

Training of Technicians

The institutes and universities described above are normally called "higher schools", and train engineers and other specialists with higher education. In addition to these schools there is a second level of technical education, or "specialized secondary" education. The various types of specialized secondary schools train technicians and other specialists for all branches of the economy.

In the 1914/15 school year there were only 450 such schools in Russia with a total enrolment of 54,000. There was only one technical school in all of Siberia at the time, and none at all in central Asia, Kazakhstan, Georgia or Armenia. During the years of Soviet power, and with the development of production, specialized secondary education has been rapidly developed. The following table shows the number of special secondary establishments and enrolments for the period 1922-1970:

	1922/23	1940/41	1950/51	1960/61	1970/71
Number of Schools	932	3,736	3,423	3,328	4,233
Enrolment (thousands)	122	975	1,298	2,060	4,388

Within this period special emphasis was placed on the training of technicians for industry, construction, transport, communications and agriculture. The following table shows enrolments in these fields:

Branch	Enrolment (thousands)				
	1927/28	1940/41	1950/51	1960/61	1970/71
Industry and Construction	38	186	450	940	1,931
Transport and Communication	9	54	89	180	380
Agriculture	30	115	162	341	693

At present there are 4,270 special secondary schools with about 4,500 million students. These schools train specialists for the intermediate group (technologists for the building trade and all other branches of industry, assistant doctors, midwives, nurses, elementary school teachers, industrial training instructors for vocational schools, etc.), in five branches of professional specialization: i.e. industrial (including industry, construction, transport and communication), agriculture, socio-economic, health and medicine, and education and culture.

The table below shows that more than half of all students enrolled in specialized secondary schools study technical and other industrial specializations (1971/72):

Branch	Enrolment (thousands)	%
Technicians and Other Industrial Specializations	2,316	52.5
Agriculture	709	16.0
Socio-Economic Specializations	486	11.0
Health and Medicine	427	9.6
Education and Culture	483	11.9
Total	4,421	100.0

All these schools are oriented towards Soviet employment requirements, and the establishment of specializations is approved by the Ministry of Higher and Secondary Special Education. This list now accounts for 403 technical specializations in the industrial branch (see Appendix 4). Appendix 5 shows the number of graduates for the last twenty years from specialized secondary schools according to specialization.

Until 1950, specialized secondary schools were usually four-year schools accepting students with complete seven-year education who could pass the competitive entrance examinations. Starting in the early 1950's new programmes began to be offered within the existing specialized secondary schools, and some of the schools changed over to one and a half to two and a half-year programmes, offering training to graduates of ten-year general schools.

Students between the ages of 14 and 30 who have graduated from an eight-year secondary school and who have passed the entrance examination are enrolled in specialized secondary schools with a three to four-year term of study. These schools give a programme of specialized secondary education, combined with the completion of full general secondary education. Graduates of ten-year secondary schools who enter specialized secondary schools have a shorter term of study because they do not have to take as many general subjects, and spend most of their time studying their major subjects.

The entrance examinations include tests in mathematics (oral and written), mother tongue, and other subjects (maximum four) appropriate to the specialization concerned. The committees which make the final selection of entrants are composed of the academic staff, some members of the school social organizations, and regional officials. All these schools in the USSR are State supported; tuition is free, and out-of-town students are given dormitory accommodation. Most of the students receive State scholarships.

Special secondary education schools, like the higher educational establishments, operate three basic types of instruction programme: full-time day, part-time evening, and part-time extension-correspondence. A specialized secondary school lies half-way between a general education secondary and university-level school. Studies are in the form of lessons and lectures with practical work being done in laboratories and workshops.

The aim of instruction in the specialized secondary schools is to train the students in skills and knowledge that will qualify them for employment at intermediate levels of professional competence. Even though these specialists are prepared for the intermediate levels their curriculum often includes some courses offered to engineers at institutions of higher learning; this is done on the assumption that the engineers and technicians will be closely associated in their work. However, the general structure of the specialized secondary education programme differs from that of higher education programmes.

A standard specialized secondary education curriculum usually consists of three main groups of subjects:

- (i) general (academic) subjects. This group consists of courses which are usually found in the upper grades of regular secondary schools: Russian language and literature, history, foreign language, mathematics, physics, chemistry, social science;
- (ii) general technical subjects. These are from two to five subjects (e.g. drawing, technical mechanics);
- (iii) specialized subjects. In this group the number of subjects ranges from 15 to 20, and its composition varies not only from one field of study to another, but even within a given field according to specialization.

The average number of hours per week in the curriculum is about forty, but can vary from thirty-five to forty-five hours. The number of subjects for the four-year programme usually ranges from 20 to 25, depending on specialization, and is reduced by at least five for students entering advanced programmes after

completion of the ten-year school. The four-year curriculum is usually based on 3,600 to 4,600 instruction hours, including applied training. In advanced two-year programmes, the number of hours varies from 1,500 to 2,000 hours.

The curriculum for each speciality is drawn up by the Ministry of Higher and Specialized Secondary Education. Annex 2 gives the curriculum of the special secondary education course for the qualification of technician in the specialization of "electrical equipment of industrial enterprises".

All of the programmes of the special secondary schools training technicians (like the engineering programmes of higher schools) require industrial practice of which there are three types: general (seventeen weeks), technological (sixteen weeks in the sixth term), and pre-diploma (six weeks in the seventh term). Technological and pre-diploma practice in specialized secondary schools is approximately the same as that for higher educational establishments, but general industrial practice differs from the latter. This is because the students of specialized secondary schools (in technical and agricultural programmes) have to obtain not only a technical qualification but also basic skilled worker training in a craft associated with the intended technical occupation.

For instance, the curriculum for the training of technicians in the specialization "electrical equipment of industrial enterprises" has four stages of general industrial practice:

- (i) four weeks in the second term (metalwork);
- (ii) three weeks in the fourth term (electrical fitter);
- (iii) two weeks in the fifth term (electrical measurement);
- (iv) eight weeks in the sixth term (practice for the obtaining of worker trade).

At the end of the sixth term students take qualifying examinations to enter one of the following trades:

- (i) automotive electrician (I-II category);
- (ii) electrician for maintenance of electrical equipment (II category);
- (iii) electrician for repairing electrical equipment (II category).

Day courses preparing technicians are in three stages. In the first stage students receive both technical and general education, learn the practical skills of a working trade and acquire a knowledge of the natural sciences involved. In the second, they start productive work in industry where they receive normal wages based on the actual work completed. During this stage academic instruction is continued by correspondence or in the evening, particularly in those subjects related to the students' employment. In the third stage, students return to the special secondary school and are again eligible for an academic scholarship. They continue their programme, outline their projects and finally complete and defend their diploma project. This diploma project is the culmination of the programme, and its purpose is to improve existing technical processes and

organization and methods in the industries concerned, by outlining more modern instrumentation, or better design of machine parts. Many of the diploma projects undertaken by graduates of special secondary schools have been adopted by the industries concerned.

Students who have completed an eight-year, or general, secondary school and are employed are eligible to enrol in evening and correspondence specialized secondary schools. These schools have no age limit, and as a rule, the term of study is one year longer than in day schools.

Evening and correspondence students in both higher and specialized secondary establishments, enjoy the following privileges. They are reimbursed 50 per cent of the cost of the return journey from their place of residence to the school, and they receive additional leave with pay for examinations and laboratory work, which for the evening courses amounts to ten days per year for the first and second years of the course, and with correspondence courses to thirty days per year. In the third year these figures increase to twenty and forty respectively. Additional unpaid leave is granted during the State examinations for a period of up to thirty days, and for the diploma project for a period of up to two months. They continue to be paid by their employer for the time spent in laboratory and practical work or examinations. In the final years of the evening or external forms of study, up to one month's leave without pay may be granted to permit the student to become acquainted with the leading industries in his specialization. Graduates of correspondence or evening establishments enjoy the same rights as students who have graduated from day higher institutes or specialized secondary schools.

VOCATIONAL TRAINING

In the USSR, the training of skilled workers is carried out in vocational schools, and through "on-the-job" activities.

Training of Workers at Vocational Schools

After the October Revolution (1917) and the Civil War, there was a serious shortage of skilled workers in Russia, so steps were taken to train workers of the required qualifications. Of particular importance to the training of workers for industry was the 1920 decree of the Soviet State "On Compulsory Technical Vocational Training" which envisaged the organization of short-term evening courses at factories. During the first years of the revolution there was no unified system for training workers and improving their skills. Some workers were trained in technical vocational schools and production shops, but in the main they were trained individually "on-the-job".

At the end of 1920, so-called FZU schools (schools of factory training) were opened in many firms. The curriculum of the FZU schools included not only industrial training, but a number of general and technical subjects. At that time, the FZU schools had to accept entrants with only three or four years of general schooling, and, consequently, the curriculum had to include many subjects of a general educational nature. For many years these factory schools played an important role in training skilled workers. Between 1929 and 1940 alone, they trained

over 2.3 million skilled workers, but they had one very serious drawback - each one was set up and run by the management of a particular enterprise, and it trained workers for that enterprise only. There were many factories, plants, and building projects that were unable to establish such schools for themselves, although building projects experienced the greatest need for skilled workers.

With the development of production, and the increasing use of more complex equipment, it became clear that the training of industrial personnel should be taken care of by centralized institutions and not by individual enterprises. To resolve the problem, in 1940, the State system of vocational training (labour reserves) was instituted. All schools were divided into two types, depending on the duration of training - vocational training schools and short-term training industrial apprenticeship schools. The main type of vocational school was based on a seven-year programme, with one to three-year courses of special studies depending on the trade.

After the Second World War, the Reconstruction and Development Plan specified those trades which most urgently demanded skilled industrial workers. Curricula and textbooks were revised and worked out anew, and special four-year vocational schools were opened for orphans who had lost their parents during the war. More than 2,000 different machines were handed over from industry to vocational schools, and factories and plants delegated some of their most able employees to work as industrial training instructors.

With the development of agriculture, collective (co-operative) farms and State farms (State-owned agricultural enterprises) possessed a great deal of farm machinery, and acquired increasing quantities of modern equipment. Thus their need for skilled machine operators steadily grew and a new type of school, rural vocational, was introduced to meet this demand.

In accordance with the law, "On Strengthening the Ties Between School and Life and the Further Development of the System of National Education", adopted by the Supreme Soviet of the USSR in 1958, a new and unified type of technical school was founded - the PTU (professional technical school) - for both urban and rural communities, which replaced all the previous types of vocational school. The new PTU schools provide trainees who have completed the eight-year general school with high grade training as skilled workers for all branches of the economy, including those branches for which such regular training was not previously provided.

Since the establishment of the State system of vocational training (1940) the number of vocational schools and students have rapidly increased:

Year	Number of Vocational Schools	Enrolment (thousands)
1941	1,551	602
1951	2,593	520
1961	3,684	1,064
1971	5,351	2,380

There are now 5,700 vocational schools in the USSR, with a total enrolment of over 2.6 million. Vocational schools of various types train workers in over 1,100 skills for industry, the building trades, agriculture, communications, and communal services. Since 1940 (when the State system of labour reserves was instituted), more than 31 million skilled workers have been trained in vocational schools.

The State offers students very favourable opportunities for training in a wide range of trades. As a rule there are no entrance examinations, and the training is free; moreover, trainees are provided either with cash allowances (State scholarships), or free food and clothes. All trainees are provided with working clothes, and are paid what they earn in the process of their practical training. Pupils are given dormitory accommodation if needed.

It is necessary to distinguish between the two types of vocational schools - urban PTU and rural PTU - which offer training from one to two years to graduates of eight-year general schools. Urban vocational schools specialize in the various branches of production. They train metal workers, lathe operators, fitters, milling machine and automatic machine operators - workers who, after graduation, will be employed in engineering plants. Some schools train workers for the building trades, still others train people who will work in transport. There are schools that train printers, dressmakers and cooks. In other words, each school has a profile of its own. The equipment in the workshops and laboratories in many urban vocational schools is as good as that in small-scale industrial enterprises. At present 2,500 urban industrial vocational schools have at their disposal a total of 60,000 metal cutting machines, 86,000 units of power equipment, 8,000 welding units, 3,000 forge press units, 10,000 woodworking units, and 2,000 building machinery units.

There are about 2,000 rural vocational schools in the USSR, and every year they train almost half a million tractor drivers and mechanics, combine operators, electricians, mechanics for livestock farm equipment, repair fitters, pumping station operators, lorry drivers, etc. In the course of the last decade, rural vocational schools have turned out 3.5 million specialists, and they are as well equipped as urban schools, having a total of about 30,000 tractors, 2,000 self-propelled vehicles, 16,000 combines, and 10,000 lorries. On a nation-wide scale, rural vocational schools have an average of 2.025 acres of crop land per trainee. The available crop land, livestock farms and extensive mechanical facilities give these schools an opportunity to organize training in conformity with the requirements of the school programme.

The educational process in these urban and rural vocational schools has four main components: industrial (practical) work which takes 60 to 70 per cent of the total time, theoretical instruction, physical education and out-of-school activities. The curriculum for each specialization is drawn up by the State Committee for Vocational Training, and includes special, general technical and general educational subjects. The curriculum for a one-year school is based on 1,500 instruction hours, and that for a two-year school on 3,000 instruction hours.

Annex 3 shows the standard curriculum for training electrician-fitters for repairing industrial equipment.

Technical progress has changed the nature of the work done by millions of people, making the labour of the worker similar to that of the engineer, technologist or agronomist. Thus, adjusters and steel-smelters spend approximately 60 per cent of their working time checking, regulating and calculating. These workers must have a thorough grounding in technical subjects, mathematics, physics and chemistry. Therefore, a secondary education becomes a necessary prerequisite for training skilled workers, which is why in recent years a large number of ordinary technical schools have been reorganized into vocational schools with a three-year course of study for training skilled workers, and giving them a full secondary education^{1/}. This is a progressive type of secondary school, training workers in difficult skills, such as: assembly of automatic production lines and computers, apparatus working for the chemical industry, machine operating for the mining and building industries, etc. Students who graduate from these schools receive a school-leaving certificate which also states their professional rating (there are six ratings).

There are now about 1,000 such schools with a total enrolment of more than 320,000 students. The curriculum of the three-year school is based on 4,570 instruction hours, of which 3,044 are devoted to technical trade skills, and up to 1,526 hours to general (academic) subjects. In time, this type of vocational school will become the dominant type of school in the system of vocational training.

There are also vocational schools that only accept graduates of ten-year general schools and train them in 250 highly specialized skills. These include training as: fitters and mechanics of measuring instruments, radio and TV assemblers and regulators, testers and turners of electric vacuum and semi-conductor instruments, computer mechanics, etc. The average term of study in these schools is one year, but the more difficult skills require from eighteen months to two years of study. The curriculum for the one-year school is based on 1,810 instruction hours, of which 1,050 to 1,250, depending upon the specialization, are devoted to technical trade skills, and up to 490 hours to technological subjects. Technical trade skill training takes up twenty-four hours in the early weeks and forty-one hours in the last weeks of training. The total number of training weeks is forty-three.

The one and a half year curriculum is based on 2,780 instruction hours, with up to 2,000 hours devoted to technical trade subjects. The two-year curriculum is based on 3,450 instruction hours, with up to 2,360 hours given to technical trade subjects. The schools train skilled workers in categories two to four of the Soviet six step skill qualification rating system.

Apart from day vocational schools, evening and part-time vocational schools also exist. These train new skilled workers without their discontinuing work, conduct upgrading courses for workers in their main profession, and help them to master second, or similar trades and so improve their technical level.

^{1/} Also, there are a number of secondary education vocational schools with a four-year course of study (mainly for the mining industry).

A special trust under the State Committee for Vocational and Technical Training produces and distributes some 2,000 different study aids for these urban and rural vocational schools, varying from teaching machines and films, one-seat student desks, blackboards (with film screens), to whole sets of equipment for special classes in drafting, technical mechanics, general metal technology, general engineering subjects, and other class and laboratory work. Most vocational schools also make some visual aids in their own workshops for themselves and for other schools.

These vocational schools are enterprises where pupils make goods which are used in industry or sold on the market. This not only ensures high industrial achievements by trainees, but also helps in the self-financing of the schools. This is why every vocational school has a production plan of its own, whose fulfilment has a direct bearing on the school's fund - spent mainly on the cultural activities and welfare of the trainees and staff.

In the last three weeks of their first year of training, the trainees must be able to fulfil the work quota of an adult worker of the first category, and, by the time they are ready to graduate, the quota of an adult worker of the second category. By a combination and correlation of studies and production, the fulfilment of production plans in no way interferes with study. On the contrary, those who work well become more skilled and acquire better habits in their trade, and show more real knowledge.

Two closely related problems have to be solved to improve the quality and minimise the cost of personnel training. Training quality depends, to a great extent, on the organization of work in the workshops. It is extremely important to achieve an order which corresponds to the requirements of the practical training syllabus, to provide every trainee with a place of work equipped with all necessary material and relevant drafts and specifications, and to plan the work of each of them in advance. Orders for the production of goods in large batches permit the development of improved methods and the introduction of minor mechanization facilities, which raises labour productivity.

Thus, the acquisition of a profession in the process of work is one of the basic principles governing the educational system of all vocational schools. The future worker not only learns his trade, he also learns to organize and plan his work and to choose the most rational technological means of production. This can only be attained under actual working conditions at factories, mines and building sites, which is why the term of study in all vocational schools is completed under actual working conditions.

Each vocational school has a "patron", which is generally a large industrial enterprise. The contact between the two is always mutually advantageous, with the "patron" usually providing new equipment and materials for workshops and laboratories, giving trainees "on-the-job" training at the plant, which it tries to relate to the school curriculum and programme. Workers, engineers and technicians share their practical experience with the young trainees.

In its turn, the plant, too, benefits directly. In the course of training the schools make tools for their "patron" in their workshops, assemble some units, and sometimes even whole machines. School instructors give the "patrons"

methodological and teaching aid in training workers and in raising the skill level at the plant itself. The main advantage, however, is that the plant is regularly supplied with new, well-trained skilled workers from the vocational school.

Since the establishment of the State system of vocational training, great attention has been paid to the training of instructors for the schools. 1943 saw the foundation of the country's first industrial teacher training college. There are now about one hundred of these colleges and they train industrial instructors for vocational and general schools. Experience gained by industrial teacher training colleges has shown that the most successful manner for training such instructors is by teaching young people who attended a vocational school, and have worked for some years in their chosen specialization. It was therefore stated that students enrolled in the colleges should be under 30 years of age, have vocational training within the framework of the vocational school (incomplete secondary eight-year education) and at least two years working experience in their field. The term of study at the colleges is three and a half years, which is reduced by one year if the student has a complete secondary education.

"On-the-Job" Training and Upgrading of Skills of Industrial Workers

No matter how good a job full-time educational establishments perform in training skilled workers, for the time being, they are only able to train a small part of those who wish to acquire or improve their working skill. At present more than 16 million people are being vocationally trained in the USSR which, after deducting the number of trainees at vocational schools, leaves more than 13 million people who are either receiving upgrading training, or are being trained "on-the-job".

The table below shows the number of industrial workers trained in new occupations, and who have upgraded their skills at industrial enterprises:

Number of Workers (thousands)	1940	1950	1960	1970
Total Number of Workers Trained in New Occupations	1,600	2,300	2,800	4,800
Total Number of Workers who Upgraded their Skills	1,500	3,500	5,400	9,000

At present, new workers can be trained in over 5,000 trades directly at their place of work. For each trade there is a specific study period which depends on the complexity of the job. Over 500 complicated trades are available including: machine operators, fitters, automatic production line adjusters, chemical equipment maintenance men, textile workers of various profiles, etc., with training periods of six months and more.

There are a great number of less complicated trades available, which have a four-month training period: mechanical assembly men, electrical repair men, grinding machine operators, millwrights, sewing machine operators, etc. The training of workers for operational jobs also occupies a significant place in

this programme. The period of training for these elementary trades is one to two months, e.g. automatic lathe operator, assembly line men, drill operators, press operators, and others.

New workers can be trained either individually or in teams without giving up their jobs. The course includes both theoretical and production training, the period of which is established for each trade in accordance with the study programme. Theoretical classes are conducted in parallel with production training, according to the following schedule:

Total period of training	1 month	-	25 to 30	hours
	2 months	-	50 to 60	"
	3 "	-	70 to 90	"
	4 "	-	90 to 120	"
	5 "	-	120 to 150	"
	6+ "	-	150 to 180	" or more

The standard curriculum for training new workers is drawn up by the State Committee for Vocational Training. (See Annex 4 for the curriculum for training electrical fitters for the installation of power equipment).

Production training is conducted directly at the work place or in special study workshops equipped with machines. The training is conducted by instructors appointed from among the skilled workers. Up to 80 or 85 per cent of the total study period is devoted to production training. Theoretical studies are also conducted at the factory. The management of the enterprise provides the necessary material bases for these; study rooms, training equipment and textbooks. The teachers are selected from highly skilled engineers and technicians employed at the enterprise. They conduct their teaching activities alongside their main occupation, either in the day or in the evenings, depending on the study schedule.

An individual training programme is where a highly skilled worker or foreman is assigned to each trainee during the production training period. Each trainee is provided with a work bench equipped with everything needed for the production training assignments. A team training programme is where the trainees are united into a study team for production training under the supervision of skilled team leaders. The management releases the skilled workers, engineering and technical personnel, from their main occupation, and pays them an average wage worked out on the basis of the three months' work preceding the beginning of the training period, to train between 12 to 15 people.

Groups of not less than 10 trainees are formed for the theoretical course, which involves trainees undergoing both individual and team training. Moreover, these groups are formed of trainees with one or more allied trades, although if it is impossible to form such groups the training is conducted by individual consultation. The number of hours set aside for consultation is determined by the following principle: up to 15 per cent of the total hours for theory for one trainee, 25 per cent for two trainees, 35 per cent for three trainees, etc.

During the period of study, trainees are paid in accordance with corresponding legislation. At the end of the course the new workers must pass a technical examination and hand in sample work for a test, after which they receive a rating in the given trade. Only those who have completed the full course of

production and theoretical training according to the fixed programme, and who attain the production standards, are allowed to take the technical examination. If the trainee fails he is given a second chance after a further two weeks.

Maximum conditions are provided for training young employees at work. Juveniles - 15 to 16 years old - work a four-hour day, while 16 to 18 year olds work a six-hour day. They learn theory within the limits of their work day, they are guaranteed an average wage during their training period, and are paid extra for the products they produce. At machine-engineering plants, machine operators who have completed a training course are given production quotas 40 per cent lower than average for the first two months, and 20 per cent lower for the next two months. In accordance with the existing labour laws, juveniles under 18 years of age are forbidden to work, or undergo training on night shifts.

Apart from the basic training of new workers in industrial enterprises, there is also widespread development of courses for the upgrading of existing workers. The standard study programmes for upgrading the skills of workers are also drawn up by the State Committee for Vocational and Technical Training, which sets aside a definite number of hours for theoretical training. For example, the study programme for upgrading a turner's skill provides 156 hours for theoretical training, including 28 hours for draughtsmanship, 38 hours to study the technology of metals, 64 hours for lathe work, and 16 hours for the fundamentals of organization and economy in production. Production training is conducted directly at the place of work, while fulfilling production assignments. The overall training period covers six months, and upon completion of the course qualification tests must be passed.

With this kind of industrial training, it is the training instructor who plays the main role. He may be a foreman, team leader or top-level worker who has taken a course in instruction. The individual training instructor must be skilled in his trade, have up-to-date knowledge of relevant production technology, know the equipment his pupils will have to deal with, and be capable of sharing his experience with them. The instructor must be recertified every two years, and only then is the new contract for training workers signed with him. The fulfilment of the contract is checked monthly by an inspector of the enterprise's industrial training department.

ANNEX 1

CURRICULUM FOR THE QUALIFICATION OF ELECTRICAL ENGINEER IN THE
SPECIALIZATION OF "AUTOMATICS AND TELE-MECHANICS" (DURATION: 5 YEARS 6 MONTHS)

Subjects	Hours					Hours per week per term											
	Theore- tical	Lab- oratory	Prac- tical	Course Pro- jects	Total	1st	2nd	3rd	4th	5th	6th	11	12	13	14	15	16
						year	year	year	year	year	year						
						1	2	3	4	5	6	7	8	9	10	11	12
1. Mathematics	226	-	192	-	418	9	7	8									
2. Physics	274	102	52	-	274	6	7	3									
3. Descriptive geometry and mechanical drawing	36	-	88	-	124	4	1	2									
4. Chemistry	68	68	-	-	136	4	4										
5. Mechanics	68	-	68	-	136		4	4									
6. Theoretical elements of electrical engineering	150	100	100	-	350		7	7	7								
7. Specialized mathematics course	141	-	64	-	205			7	3		3						
8. Specialized physics course	48	16	-	-	64			4									
9. Technology of metalwork, structural materials, work at workshops	36	48	-	-	84			2	3								
10. Elements of instrument designing	80	-	16	16	112			6	1								
11. Electrical measurements	80	48	-	-	128				8								
12. Electromagnetic instru- ments and technology	70	28	-	14	112					8							
13. Elec. miniature machines	88	29	-	-	117					3	5						
14. Electronic and semi- conductor technology	136	60	-	-	196					7	6						
15. Pulse technology	60	30	-	-	90							6					

Diploma Project

ANNEX I (Contd.)

Subjects	Hours					Hours per week per term											
	Theore- tical	Lab- oratory	Prac- tical	Course Pro- jects	Total	1st year 1 2	2nd year 3 4	3rd year 5 6	4th year 7 8	5th year 9 10	6th year 11 12						
16. Use of computers in en- gineering and economic computations	84	42	-	-	126			3	6			Diploma Project					
17. Theory of automatic control	129	30	57	-	216			5	6	4							
18. Theoretical grounds of information technology	101	42	44	-	187				5	8							
19. Automatic control	48	32	-	20	100					8	2						
20. Making of electrical instruments	62	-	-	-	62					3	2						
21. Elements of safety and fire control engineering	28	14	-	-	42					3							
22. Political economy	50	-	70	-	120		4	4									
23. Industrial economics	30	-	10	-	40						4						
24. Management and organiza- tional structure of enterprises	70	-	20	-	90						9						
25. Physical training	-	-	136	-	136	2	2	2	2								
26. Humanities	100	-	279	-	379	7	7	2	2	3	8						
27. Educational research	-	80	-	-	80						4	4					
28. Subjects established by the council of science	122	-	10	20	152					3	4	5					
Total	2,231	769	1,206	70	4,276	32	32	30	35	30	25	28	35	22	20		

Supplement to Annex 1

Additional Information on the Curriculum

I Optional courses

Drawing
Physical training
Humanities

II Time Budget in Weeks

Instruction	153
Examinations	31
Industrial practice	35
Diploma Project	21
Vocations	46

Total 286

III Instruction Schedule

Weeks in term:

1	2	3	4	5	6	7	8	9	10	11
18	16	18	16	16	14	15	14	10	10	21

IV Examination Schedule

Graded examinations	42
Qualifying examinations	44
Graded course work	4

ANNEX 2

**CURRICULUM OF A SPECIAL SECONDARY EDUCATION COURSE FOR THE QUALIFICATION OF
TECHNICIAN IN THE SPECIALIZATION OF "ELECTRICAL EQUIPMENT OF INDUSTRIAL ENTERPRISES"
(DURATION: 3 YEARS 6 MONTHS)**

Subjects	Hours				Hours per week per term							
	Total	Theore- tical	Lab. and practical work	Course Pro- jects	1st year 1 2	2nd year 3 4	3rd year 5 6	4th year 7 8	Diploma Project			
I General												
History	180	180			4 4	2						
Social Science	70	70				2	2					
Literature and Russian language	201	201			4 2	2 3						
Mathematics	416	416			8 7	6 2						
Physics	198	166	32		6 5							
Chemistry	144	110	34		6 2							
Foreign language	146	146			2 2	2 2						
II General Technical												
Drawing	144		144		4 2	2						
Technical mechanics	130	122	8			3 4						
III Special												
Theoretical grounding of electrotechnics	198	152	40		4	7						
Electrical materials	108	88	20		6							
Electrical measurements	76	46	30				4					
Fundamentals of industrial electronics	90	70	20			5						
Fundamentals of automation & computer technics	92	76	16					3				
Electrical machines and transformers	159	109	50			3 3	3					
Electrical drive	96	80	16				6					
Electrical supply of industrial enterprises	178	134	24	20		6	4					
Fundamentals of technology of the branch	57	57				3						
Electrical equipment of industrial enterprises	154	104	30	20		3	4	3				
Assembly, operation and maintenance of industrial electrical equipment	114	78	36				3	6				
Economics, organization and planning of production of the branch	141	105	24	12			4	7				
Safety of labour and fire prevention measures	44	44						4				
Narrow specialization	120	120					2	8				
Physical training	344	344			2 2	4 4	5	4				
Total	3,600	3,024	524	52	36 36	36 36	36	36				

Supplement to Annex 2

Additional Information on Curriculum

I Optional courses

Foreign language
Physical education

II Time Budget in Weeks

Instruction	100
Examinations	7
Industrial practice	39
Diploma Project	8
Vocations	<u>28</u>

Total 182

III Instruction Schedule

Weeks in term:
1 2 3 4 5 6 7 8
18 18 18 19 16 16 11 8

IV Examination Schedule

Graded examinations	16
Qualifying examinations	13
Graded course work	3

ANNEX 3

CURRICULUM OF TRAINING FOR ELECTRICIANS/FITTERS
FOR REPAIRING INDUSTRIAL EQUIPMENT
(DURATION: 2 YEARS)

Hours

Subjects	First year			Second year			Grand Total
	Terms ^{1/}		Total	Terms ^{1/}		Total	
	I	II		I	II		
	per week			per week			
Industrial training	18	18	720	18	36	1,080	1,800
Design and repair of industrial electro-equipment	4	6	200	6	2	160	360
Fundamentals of automatization of industrial electronics	-	-	-	2	-	40	40
Electrical engineering	4	4	160	4	-	80	240
Course of electrical materials	2	2	80	-	-	-	80
Drawing	2	2	80	2	-	40	120
Mathematics	4	2	120	-	-	-	120
Social and economic subjects	2	2	80	4	-	80	160
Total	36	36	1,440	36	38	1,480	2,920
Physical training (not included in timetable)	2	2	80	4	-	80	160

^{1/} Each term of 20 weeks duration.

Examinations are held in the following subjects:

In the first year : course of electrical materials

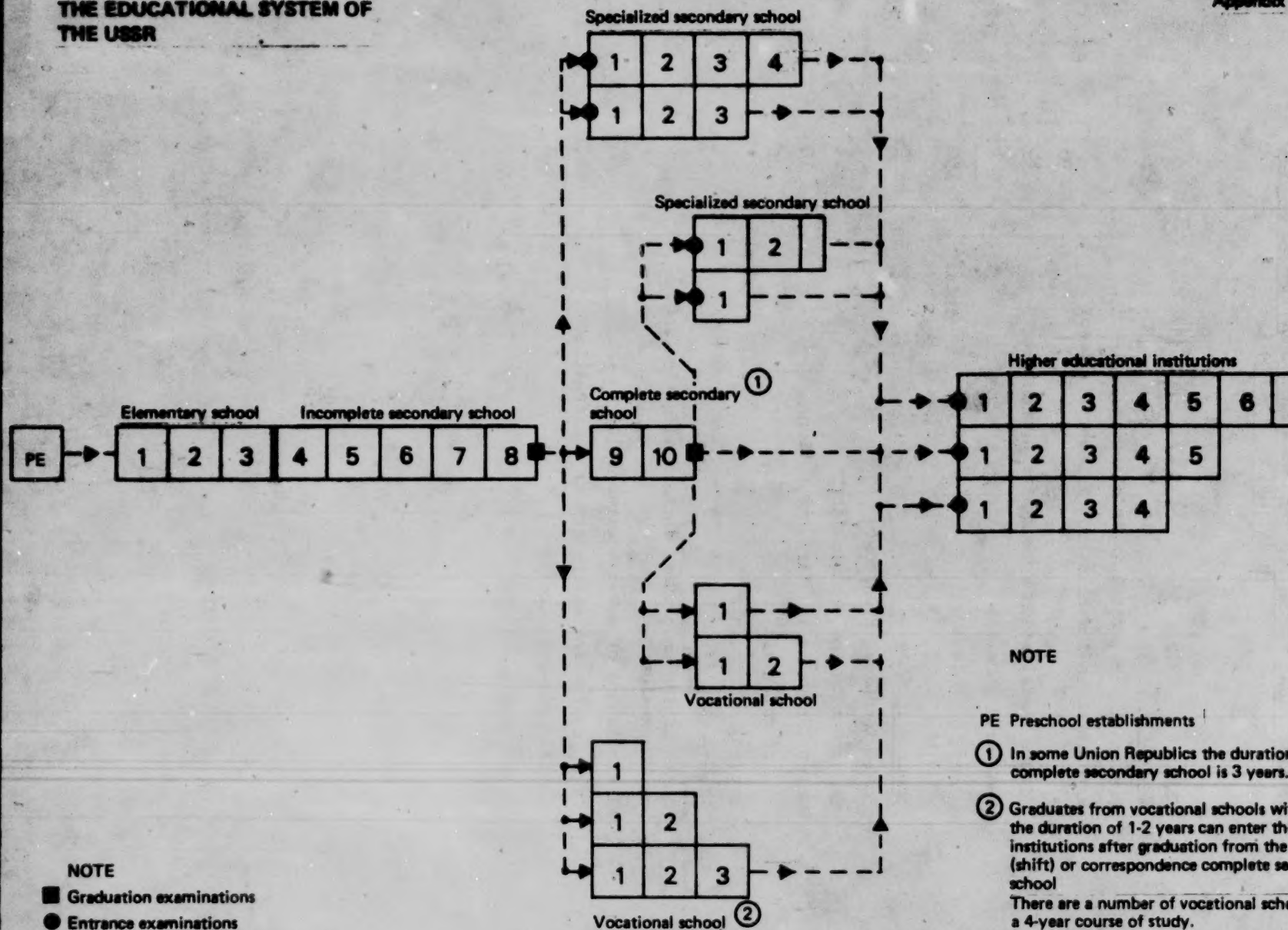
In the second year: design and repair of industrial electrical equipment;
 electrical engineering.

ANNEX 4

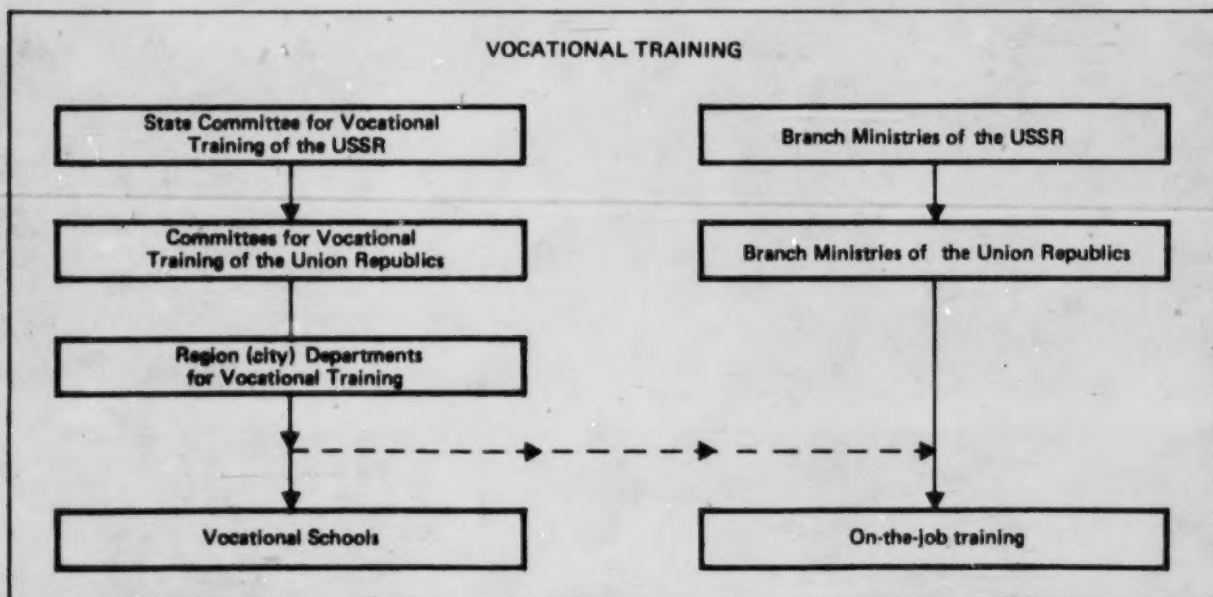
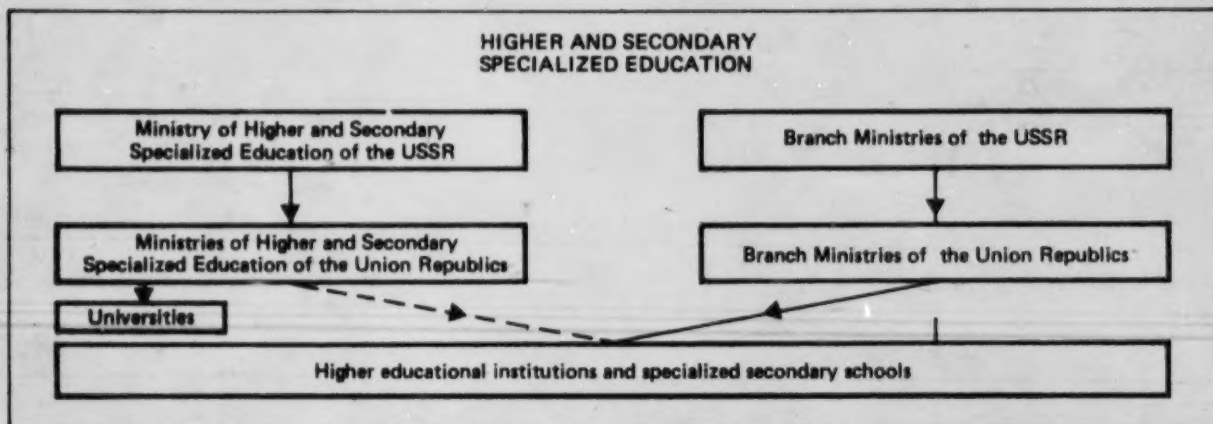
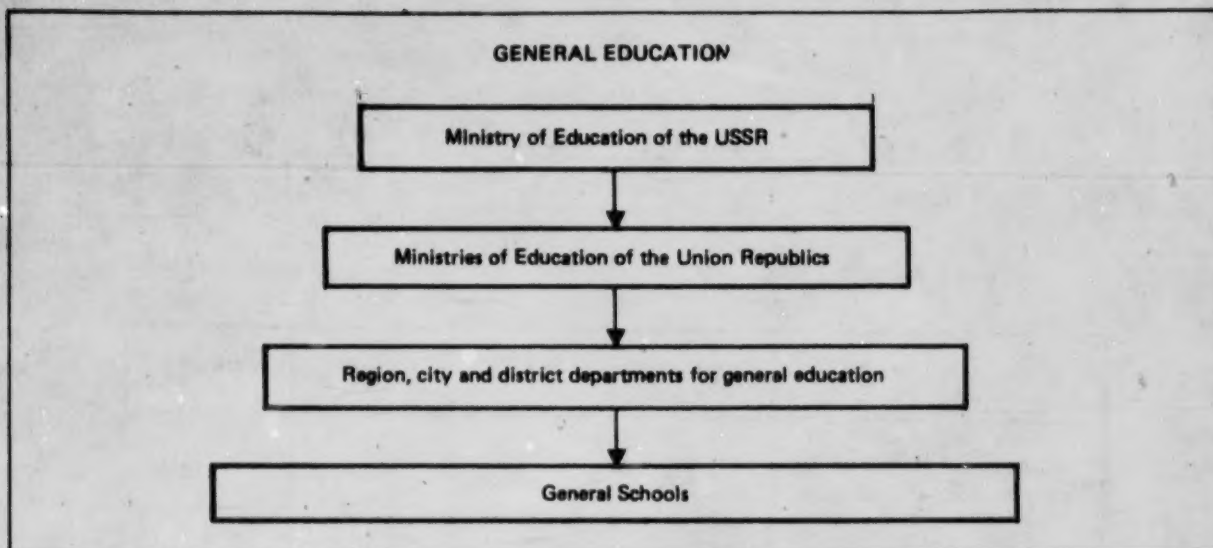
CURRICULUM FOR INDIVIDUAL AND TEAM TRAINING IN THE TRADE
OF ELECTRICAL FITTER FOR THE INSTALLATION OF POWER EQUIPMENT
(DURATION: 6½ MONTHS)

<u>Practical</u>	<u>Days</u>
Practical work, basic instruction	2
Experience in installation of power equipment II category	98
Simple installation work by the apprentice	49
Qualification test	1
Total	150

<u>Theoretical</u>	<u>Hours</u>
Basic technical knowledge	2
Construction and organization	4
Safety, hygiene and fire precautions	10
Use of materials	20
Reading of drawings	24
Electrotechnics	40
Installation procedure: industrialization and mechanization	12
Installation of power equipment	66
Organization and management of construction	10
Revision and registration	4
Total	192



EDUCATION MANAGEMENT IN THE USSR



NOTE: —————> direct subordination; - - - - -> methodological supervision

APPENDIX 3

ENROLMENT IN GENERAL EDUCATIONAL SCHOOLS (ALL TYPES)

(Thousands)

	1940/41	1950/51	1960/61	1970/71
Number of general educational schools	199	222	224	190
Enrolment	35,552	34,752	36,187	49,373

APPENDIX 4

THE DISTRIBUTION OF ENGINEERING AND TECHNICAL SPECIALIZATIONS
AT HIGHER (A) AND MIDDLE (B) LEVEL EDUCATIONAL ESTABLISHMENTS

Field	No. of specializations	
	A Engineering level	B Technician level
Geology and exploration of mineral deposits	8	6
Exploration of mineral deposits	11	11
Power engineering	15	23
Metallurgy	11	19
Machine building and instrument construction	77	108
Electrical machine building and electrical instrument construction	50	60
Radio engineering and communication	8	21
Chemical technology engineering	36	32
Timber engineering and technology of wood processing, cellulose and paper manufacturing	4	10
Food products industry	17	19
Consumer goods industry	14	36
Construction	19	23
Geodesy and cartography	4	7
Hydrology and meteorology	5	5
Transportation	15	24
Total	294	403

APPENDIX 5

NUMBER OF GRADUATES FROM HIGHER (A) AND SPECIAL SECONDARY (B) ESTABLISHMENTS
(Thousands)

Field and Specialization	A			B		
	1950	1960	1970	1950	1960	1970
<u>I Engineering and other industrial specializations</u>						
Geology and exploration of mineral deposits	1.7	3.9	5.1	1.8	2.5	4.8
Exploration of mineral deposits	1.4	5.3	6.3	6.0	14.1	11.7
Power engineering	2.4	8.4	10.5	7.7	15.4	44.8
Metallurgy	1.4	3.9	6.5	4.9	5.6	10.2
Machine building and instrument construction	9.1	30.6	69.0	26.6	74.9	124.0
Electrical machine building and electrical instrument construction	1.4	8.1	40.5	2.4	6.8	31.8
Radio engineering and communication	1.4	6.3	19.8	5.2	12.5	30.9
Chemical technology engineering	2.6	5.7	16.1	4.4	7.0	23.3
Timber engineering and technology of wood processing, cellulose and paper manufacturing	0.7	3.7	3.3	2.4	6.7	8.5
Food products industry	2.3	3.5	7.9	4.9	12.0	28.8
Consumer goods industry	1.2	3.1	5.4	5.0	9.0	24.7
Construction	4.9	17.7	30.3	14.6	34.2	61.9
Geodesy and cartography	0.3	0.6	1.0	0.8	1.5	1.5
Hydrology and meteorology	0.4	0.7	1.1	0.6	1.4	1.7
Transportation	3.1	6.6	14.9	11.1	21.3	55.6
Total	32.3	108.1	200.3	107.3	224.9	464.9
<u>II Agriculture and forestry</u> Total	12.9	34.5	58.3	46.6	67.2	120.1
<u>III Socio-economic</u> Total	15.8	36.7	83.7	26.3	71.6	188.6
<u>IV Medical and health</u> Total	20.7	30.6	43.8	52.4	64.4	138.5
<u>V Education, arts and entertainment</u> Total	95.2	133.4	244.7	81.1	55.4	121.2
Grand total	176.9	343.3	630.8	313.7	483.5	1,033.3

L'EDUCATION POUR LE DEVELOPPEMENT RURAL:
FAUT-IL "RURALISER" L'ENSEIGNEMENT PRIMAIRE?

par

R. Brain

L'EDUCATION POUR LE DEVELOPPEMENT RURAL :
FAUT-IL "RURALISER" L'ENSEIGNEMENT PRIMAIRE?

Le présent article soutient que, dans les conditions de la vie rurale, il ne serait pas bénéfique d'introduire l'étude de l'agriculture dans l'enseignement primaire rural, car le but principal de ce dernier est d'assurer l'acquisition des mécanismes de base comme la lecture et l'écriture. En revanche, il est possible d'améliorer les liaisons de l'enseignement primaire avec l'éducation des adultes, la vulgarisation agricole, le développement communautaire, les actions sanitaires et sociales, afin de mieux coordonner les efforts de transformation rurale.

Ce sujet ne sera traité ici que brièvement, et nous ne tenterons pas d'étudier en détail les processus et les problèmes du développement rural. Cependant, l'éducation étant l'un des éléments qui influent sur ce développement, il convient de souligner la nécessité d'une planification et d'une gestion d'ensemble de tous les facteurs du développement rural, par exemple au plan régional.

Faut-il étudier l'agriculture à l'école primaire?

Certains auteurs soutiennent qu'en milieu rural l'enseignement primaire devrait faire une large place à l'agriculture, afin d'aider les élèves à trouver plus tard un emploi. Selon eux, une telle mesure aurait des effets bénéfiques sur le développement rural et national, car elle favoriserait la diffusion de meilleures techniques agricoles et ralentirait l'exode rural.

Cette approche est cependant discutable, qu'on l'envisage sous l'angle conceptuel ou sous l'angle technique.

D'une façon générale, il est évident que l'adoption d'un type d'éducation spécial pour les ruraux irait à l'encontre du principe d'égalité des chances en matière d'éducation. Cette proposition se heurterait d'ailleurs fréquemment à l'opposition des parents et des élèves, en particulier dans les anciens territoires coloniaux. En effet, dans ces pays, les personnes qui ont des titres universitaires se sont en général rapidement élevés à des positions d'autorité et de prospérité financière dans le cadre de la fonction publique et leur exemple a souvent une grande influence psychologique sur l'attitude du public à l'égard de l'enseignement.

D'autre part, on pourrait soutenir qu'une certaine migration des campagnes vers les villes est inévitable dans une société en cours de modernisation ; elle peut être bénéfique quand elle permet d'agrandir les exploitations agricoles et de les rendre plus productives. N'est-il pas probable que les personnes ayant reçu une éducation nettement orientée vers la vie rurale éprouveront plus de difficultés à s'adapter aux conditions urbaines et se trouveront défavorisées sur le marché du travail?

A ce propos, alors que l'on a beaucoup écrit sur la nécessité de créer des formes spéciales d'enseignement pour les milieux ruraux, constatons que l'on n'a accordé que peu d'attention à l'enseignement urbain dans les pays en voie de développement. Cela est curieux, attendu que l'urbanisation rapide est caractéristique de la plupart de ces pays et qu'il n'est pas facile de transformer un migrant rural en citadin productif. Si le secteur rural est souvent beaucoup plus important que le secteur urbain par le volume de la production et le nombre des habitants, en revanche chaque citadin absorbe une part beaucoup plus forte du capital national que ne le fait un villageois. Dans ces conditions, s'il faut un type spécial d'enseignement primaire pour permettre aux ruraux de participer plus efficacement au développement, pourquoi n'insiste-t-on pas également sur la nécessité d'une éducation spécialement conçue pour produire des citoyens utiles à la collectivité? D'un point de vue plus technique, constatons d'abord que l'enseignement et la formation agricoles ne constituent que l'un des nombreux facteurs d'accroissement de la production agricole. D'autres éléments comme la structure des prix, le régime foncier, la commercialisation des produits et le manque de moyens de transport sont souvent les principaux obstacles au développement agricole et la formation ne pourra avoir d'effet que si l'on entreprend simultanément des efforts pour les surmonter.

Le type d'enseignement agricole à donner aux jeunes villageois pose un autre problème. Souvent les enfants eux-mêmes ont des connaissances agricoles étendues, normalement transmises de génération en génération. Il arrive même qu'ils quittent l'école à l'époque des grands travaux pour aider leurs parents, ou qu'ils travaillent aux champs en dehors des heures de classe. L'agriculture traditionnelle est généralement bien adaptée aux conditions locales et les changements que l'on y introduit risquent d'en rompre l'équilibre. Il faut donc beaucoup de prudence dans l'introduction des méthodes améliorées. Les enfants élevés dans le contexte local sont généralement conscients de ces problèmes alors qu'un maître venu de l'extérieur risque de les ignorer si sa formation agricole est insuffisante.

Les arguments ci-dessus tendent donc à montrer l'inutilité d'enseigner une agriculture pratique du type traditionnel. On pourrait cependant recommander l'enseignement de l'agriculture moderne ou d'une agriculture plus évoluée ; mais alors la question se pose de savoir quand les élèves seront en mesure de mettre en pratique ce qui leur aura été enseigné. Dans la plupart des cas, ils sont trop jeunes à leur sortie de l'école pour assumer la responsabilité directe de certaines activités agricoles, ils ne pourront le faire qu'au bout de trois ans au moins. Par ailleurs, il est peu courant en milieu rural que les parents apprennent quelque chose de leurs enfants, car les traditions rurales reposent normalement sur la transmission du savoir des plus âgés aux plus jeunes.

Le rôle de l'enseignement primaire

Mais la plus importante objection que l'on peut faire à l'introduction de l'agriculture dans l'enseignement primaire concerne le rôle de celui-ci. En effet, l'importance fondamentale de l'enseignement primaire réside moins dans

les connaissances qu'il enseigne que dans les instruments de base qu'il donne et qui permettront ensuite le développement de la personnalité. Sans doute est-il possible de se former sans avoir appris à lire, à écrire et à compter ; inversement, on peut savoir lire et écrire sans être pour autant éduqué. Mais les instruments que constituent la lecture et l'écriture permettent une éducation plus continue. Le rôle principal de l'enseignement primaire, que ce soit dans un contexte urbain ou un contexte rural, est donc de fournir les instruments nécessaires à la démocratisation de l'éducation et à sa prolongation pendant toute la vie des individus, soit par des lectures personnelles, soit par la poursuite d'études supérieures.

L'importance attachée aux éléments de base de l'enseignement primaire, lecture, écriture et calcul, le temps qui leur est consacré, peuvent sans aucun doute varier selon le type de société où cet enseignement est dispensé. Dans une société alphabétisée, l'enfant vit dans un milieu où savoir lire et écrire est chose courante, et où la transmission de ces techniques de génération en génération s'effectuerait probablement même si elles ne faisaient plus l'objet d'un enseignement institutionnalisé. Dans ces conditions, il est évident qu'on peut accorder plus d'importance à des aspects plus généraux de l'éducation, et laisser du temps à l'enfant pour lui permettre de former sa personnalité selon les voies qui lui sont propres.

Dans une société analphabète, la situation est inverse ; il faut accorder plus d'importance aux outils de base de l'éducation, puisqu'en dehors du cadre scolaire l'enfant ne trouve ni stimulants, ni aide, ni attitudes compréhensives propres à renforcer l'oeuvre de l'école. Le mieux qu'on puisse espérer en pareil cas est que la génération adulte assimile en même temps les mêmes techniques, grâce à des campagnes d'alphabétisation fonctionnelles et à d'autres programmes éducatifs.

Si l'on part de ce point de vue, on peut considérer que la première mission de l'enseignement primaire est de fournir les bases d'une éducation permanente. Une fois ce but atteint, on peut discuter des autres éléments à introduire dans l'enseignement primaire. Il faut cependant tenir compte, dans les programmes éducatifs, de ce que l'on pourrait appeler "l'effet parasol". Nous entendons par là l'effet d'un cycle d'éducation sur le cycle immédiatement inférieur : le contenu de l'enseignement universitaire tend à peser sur les caractéristiques de l'enseignement secondaire, et ce qui est enseigné dans les établissements du second degré influe sur l'enseignement primaire. Cela est dû en partie au désir des élèves, appuyé par leurs parents, de pousser leurs études aussi loin que possible, en partie au fait que les enseignants se recrutent au niveau immédiatement supérieur à celui où ils enseignent.

En raison de ce qui précède, il est normal de constater que les éléments que l'on ajoute aux connaissances de base de l'enseignement primaire sont le plus souvent ceux qui mènent à l'enseignement du second degré, même si la grande majorité des élèves n'est pas appelée à y entrer. De même, des réformes dans l'enseignement du second degré entraînent souvent, à long terme, des changements dans l'enseignement primaire. D'une façon générale, il est donc peu réaliste d'étudier un degré d'enseignement donné sans tenir compte de ses liens avec les autres niveaux.

Concluons donc que les éléments d'enseignement agricole que l'on peut ajouter au programme des écoles primaires dépendent du temps nécessaire pour enseigner aux enfants les mécanismes de base comme la lecture et l'écriture et souvent les matières préparant à l'enseignement du second degré. Il est fréquent que les écoles rurales soient d'un niveau médiocre, et présentent des taux élevés de redoublements et d'abandons. Par ailleurs, les communautés parmi lesquelles se recrutent leurs élèves sont généralement analphabètes, et l'on pourrait soutenir qu'il faut beaucoup plus de temps pour inculquer ces mécanismes de base dans les milieux ruraux que dans les milieux urbains correspondants. Le temps qu'on pourrait consacrer à l'agriculture risque donc d'être très limité.

Reconnaissant ces difficultés, on a formulé d'autres suggestions touchant le rôle de l'école primaire dans le développement rural et agricole ; ces suggestions tendent à un compromis entre un enseignement primaire à contenu agricole et un type d'enseignement primaire normalisé à l'échelon national. Elles peuvent être groupées en deux catégories : l'une recommande d'adapter le contenu de l'enseignement primaire à l'environnement, de telle façon que le rudiment soit enseigné avec ce qu'on pourrait appeler "une saveur rurale" ; l'autre cherche à utiliser les moyens dont dispose l'école pour des activités qui débordent le cadre d'un simple enseignement primaire, allant jusqu'à remplacer l'école primaire par un centre d'enseignement communautaire.

Adaptation du contenu de l'enseignement primaire^{1/}

Il s'agit de recourir plus souvent à l'environnement socio-culturel local pour l'acquisition des connaissances de base. Les premiers livres de lecture, par exemple, s'inspirent des contes populaires locaux ; les études sociales commencent par celle des institutions et de l'économie du village lui-même ; les premières notions d'arithmétique sont enseignées au moyen des poids et mesures localement en usage ; autrement dit, l'enseignement tire sa substance du milieu local.

En même temps, on prend des mesures pour que le niveau scolaire atteint par les élèves ne soit pas inférieur au niveau national général, de manière que les enfants de la campagne puissent, en dehors de toute discrimination, bénéficier des mêmes possibilités de poursuivre leurs études que les autres enfants. A beaucoup d'égards ce principe d'adaptation relève de la pédagogie générale ; le même principe d'adaptation aux conditions locales pourrait d'ailleurs être appliqué aussi en milieu urbain.

La mise en oeuvre de cette conception exige de grands efforts et l'adoption d'une politique à long terme fondée sur une action planifiée, lente et continue. Les maîtres ont besoin d'une formation méthodologique ; il faut élaborer un matériel d'enseignement spécial (manuels, etc.) ; une structure adéquate est nécessaire. Or, cette infrastructure de l'enseignement fait encore défaut dans beaucoup de pays en voie de développement.

^{1/} Pour plus de détails sur cette question, voir "Agriculture et enseignement général", Etudes et documents d'éducation, No.2, Unesco.

Une autre variante de ce principe d'adaptation consiste, tout en employant un matériel tiré de l'environnement, à mettre l'accent sur l'utilité directe des éléments enseignés. Ce principe est à la base de l'enseignement tanzanien qui vise à développer chez les élèves le sens de l'autonomie : on s'attache à les familiariser avec les problèmes et les réalités de la vie rurale, de manière qu'ils puissent plus tard participer directement à la transformation de la vie des villages. Cela n'implique pas nécessairement l'enseignement des pratiques agricoles elles-mêmes, mais l'inculcation d'une certaine idée du développement rural et du rôle que chacun peut jouer dans ce développement. On pourra ainsi être amené à introduire dans les programmes d'études des notions élémentaires de socio-économie.

Elargissement du rôle de l'enseignement primaire

L'école primaire est en général le premier investissement des pouvoirs publics dans un village, et cependant les installations n'en sont souvent utilisées que pendant un nombre d'heures restreint. Rien ne semble devoir s'opposer à les employer pour d'autres activités (cours d'adultes, cours destinés aux femmes, etc.), ce qui ferait de l'école primaire un foyer d'action éducative générale. Par exemple les services agricoles pourraient utiliser les terrains de l'école comme parcelles de démonstration, et l'agent de vulgarisation pourrait faire une causerie aux enfants sur l'évolution récente de l'agriculture. On pourrait également donner au directeur de l'école une formation qui lui permettrait de jouer un rôle de liaison : il saurait où adresser les gens qui ont besoin de conseils, il serait au courant des déplacements de l'agent de vulgarisation ; il saurait où se trouve le centre médical le plus proche, et serait au courant des dernières circulaires administratives de nature à intéresser les gens du village, etc.

En poussant l'idée plus loin, on en arrive à concevoir la possibilité de remplacer l'école primaire par un centre éducatif communautaire. Ce centre serait ouvert aux enfants et aux adultes de tous âges quelles que soient leurs études antérieures. On pourrait y conserver les classes primaires normales, mais en accroître les moyens éducatifs en y introduisant les locaux de formation ("unités de travail") préparant à divers métiers : agriculture, artisanat local, menuiserie et travail des métaux, construction de bâtiments, réparation d'outils et machines simples, etc. Cette approche pourrait contribuer à la survivance de l'artisanat et des traditions culturelles locales. Des enseignements complémentaires pourraient être donnés dans d'autres secteurs de l'éducation des adultes : enseignement ménager, hygiène, régulation des naissances, par exemple, allant de pair avec une alphabétisation fonctionnelle. L'enseignement serait donné par des enseignants de métier et par d'autres personnes - artisans locaux, agents de vulgarisation agricole, agents sanitaires, etc. - ; il pourrait être renforcé par l'emploi de la radio ou de la télévision.

Les principaux problèmes que soulève ce genre d'approche, en dehors du financement, sont souvent d'ordre administratif. La question se pose de savoir qui organisera et gèrera ces cours, le directeur de l'école primaire, un agent de développement communautaire, un agent de vulgarisation agricole ? Ce problème est étroitement lié au problème général de tout développement rural efficace, celui des chevauchements d'attributions et du manque de coordination sur le terrain entre les différents services officiels.

En conclusion, même s'il est concevable d'utiliser des méthodes d'enseignement différentes en milieu rural et en milieu urbain, la dichotomie d'un système qui distinguerait "l'enseignement rural" de "l'enseignement" tout court ne saurait probablement répondre aux besoins des populations rurales, dont le principal désir est généralement d'atteindre un niveau de vie et une qualité de vie équivalant à ceux qu'elles croient être de règle en milieu urbain. Dans les conditions actuelles de la société, alors que l'éducation reçue dépend souvent étroitement de la condition sociale et des ressources financières de la famille, le système d'enseignement idéal devrait être un système sans barrières, permettant à un enfant de la campagne d'atteindre par la suite un niveau égal à celui d'un enfant de la ville doué des mêmes aptitudes.

ANOTHER DIMENSION IN ENGINEERING EDUCATION

by

K.A. Everard

ANOTHER DIMENSION IN ENGINEERING EDUCATION

Background

Engineering activity is as old as civilization itself. Originally an art, works of great complexity preceded, in some cases by centuries, the scientific explanation of the physical laws governing them. The converse has also been true in more modern times and projects, known by science to be feasible, have had to wait for technology to make them possible. The gap between science and technology has become progressively smaller and this has been reflected strongly in the training patterns now followed. Engineering education in most industrialized countries has tended to dispense with those parts of the curriculum concerned with description and technique. Workshop training within the academic institution has been virtually abandoned and engineering undergraduates now concentrate largely on fundamentals intended to prepare them for life-long professional development.

Academic training in many countries has become more analytical and high standards of mathematical and scientific skill are expected. At the same time, because they are surrounded by engineering situations, students in their final year are expected to be able to take part in the solution of a problem. Such students, entering sophisticated industry at the forefront of technological progress are provided with opportunities to acquire practical experience in abundance. Not all engineering is innovative, however: there is much routine, and considerable time is spent in the latter half of many careers in supervision and management, for which a knowledge of the social sciences is a considerable advantage.

Many engineering educators in developed countries hold the view that the role of the university is to assist in the formation of minds and not to train in techniques. To this end, emphasis is placed on depth, rigour and subtlety. Whilst recognizing the importance of the social sciences in engineering practice, problems arise. Introductory courses in fields not directly related to the engineering sciences tend to be trivial and certainly in their demands on the students' intellectual capacity are of an order quite different from the main stream of study. An apparent lack of relevance to this main stream is often resented by students, particularly by those academically more able. The relevance thus needs to be demonstrated around a real engineering situation.

It has been noted that much of the day-to-day work of an engineer is of a routine nature. Much, but certainly not all; decisions need to be taken from time to time which can be far reaching and expensive. Those who have been heard to complain that they have not used in their careers a considerable proportion of the material given to them at the university may have missed the point of university education. The demands made in taking far-reaching decisions, no matter how infrequent, justify rigour and fundamentals.

But how does this apply to engineering education in developing countries? In many such countries manufacturing sectors are small, concerned with manufacturing under licence and with food processing: the research and development functions and design are limited. The requirements of the service industries - power, posts and telecommunications, water supply and so on - are mainly for skills in operation and maintenance. In construction, some countries rely considerably on the services of foreign consultants for design and supervision. As a result potential engineers in many developing countries are exposed to a smaller spread of activity within their own economy: the obtaining of broad practical training presents great problems.

There have been temptations to suggest that a fundamental type of education is unsuited to the needs of developing countries. Advice has been to reintroduce the workshop training and to make the courses "more practical". This advice is mostly rejected; international recognition rather than national relevance is often the prime objective and, indeed, such advice is often regarded with suspicion as having political overtones with motives to continue the dependence of developing countries on metropolitan industries. The universities, themselves, are striving to become centres of excellence, and there is no doubt that proposals made by new Faculties of Engineering for what Senates regard as something other than "internationally recognized" are unacceptable.

The salient features are, therefore, a demand for academic rigour comparable to that in industrialized countries coupled with a smaller spread of industrial activity, together with a further constraint in that academic staff often lack industrial experience themselves.

Thus exposure on the job needs to be supplemented in a deliberate and more formal fashion. A study in depth of an engineering project from its inception to its commissioning can be of great value. In a major project a wide spread of engineering activity is possible, exposure to which would take many years in practice.

Audio Visual Aids in Engineering Education

It is suggested that the full potential of films in engineering education has not been realized. Many short films have been produced which, although well done and serious in intent, have not been regarded as such by students. Normal reactions are an amalgum of passing interest and light entertainment.

Yet the film can be used to illustrate with an effectiveness even unmatched by the live watching of actual operations. The dimension added by experience gained during actual participation in, and responsibility for, part of an engineering project, is missing. There can be no substitute for the taking of responsibility but, with this limitation realized, the co-ordinated scheme described below can add dimensions not yet realized in engineering education. To describe the proposal, an example is taken of the development of a hydro-electric project.

The civil engineering aspects are chosen here to illustrate the concept in detail.

The study has two main dimensions. The first is a series of films, following all phases of the hydro-electric scheme from its conception, through its design and construction, to its commissioning and review. Parallel to the showing of films is the study of a manual. Contained in the manual would be notes highlighting the points of major interest in the films and introductory chapters to subjects of general concern to the engineer. The series proposed consists of eight films each lasting 40 minutes. Each film is complete in itself, handling one aspect of the project, but they are made so that, viewed as a whole, the scheme is cohesive.

The first two films would be common to each branch of engineering, from which all students would derive some insight into the machinery of government, the economics of development and some aspects of the social impact of engineering works. The six subsequent films have been planned to show the role of civil engineering.

The Films

1. Introduction

A review of national planning for economic development and the bodies involved. (This section would be similar to a lecture but would make free use of animated cartoon styles with live flashes showing, for example, land before and after irrigation; an area earmarked for development simultaneously for agricultural upgrading - irrigation - and industrial development - power). Initiation at government level; economic survey and justification in overall terms; proposed benefits both in the short and long terms; social benefits.

Discussions at federal and state government level; committees and the role of parliament; feasibility studies; financing - national and international.

2. Project Planning

Engineers appointed to report. Details of feasibility studies and how they are carried out. What detail is required at this stage. Survey - topographical and social. A review of the problems - long term and short term (for example, those concerned with the resettlements of communities disturbed by flooding the impounding reservoir). Review of timing and initial estimates of rate of expenditure; availability of labour; materials; equipment. The Report.

3. Design

The collection and verification of basic data, stream gauging, meteorology, site investigations; the use of specialists, hydrologists, geologists, etc; model investigations and the use of the laboratory in design (compare with quality control laboratories at the construction stage).

4. Detailed Design

Review of design methods, idealizations and approximations, Codes of Practice, Government Regulations and By-laws; methods of calculation and the use of computers, digital and analogue.

Production of working drawing, specifications and contract documents.
The role of consultants and contractors. Tendering, the award of the contract.

5. Construction: planning and organization

Project planning and the setting of targets. Control of work by the contractor's agents and the consulting engineer. Organization required. Mustering and phasing of resources - money, men, materials and machinery; labour welfare, safety precautions, trade unions.

6, 7. Construction: operations

The unit operations - excavation and filling; cofferdams and timbering; pumping and dewatering; piling; form work and centering; erection; concreting; precasting and industrialized building operations, prestressing; the use and performance of mechanical plant-excavators, tractors, cranes, compactors, pumps, concrete mixers, stressing equipment, trucks and other transport; maintenance. Schedules of plant and their importance; maintenance operations and equipment needed.

The economics of unit operations.

The installation of permanent plant - turbines, generators, etc.

Commissioning.

8. The Scheme Completed and in Operation

A critical review of the scheme. In what ways have economic and social objectives been met? What improvements would be made in future schemes in the light of experience gained on this? A review of the design - utility and economy. A review of constructional methods.

The films have been listed in the order in which operations would normally be carried out. For pedagogical reasons it might be advantageous to change the order during the showings. For example, a run through of the unit operations might be of benefit, before a detailed discussion on tendering, which involves costing those operations.

The Manual

The manual is a vital part of the audio-visual project study. Its object is to provide notes on all the major aspects of the project illustrated in the films, amplifying the film material where necessary and providing introductory chapters to general subjects such as economics and management. An important feature would be the inclusion of a comprehensive bibliography for further study. The manual is in two parts.

Part I:

Chapter I: Elements of Government

Parliament, the Legislature, the Executive, the Judiciary; the role of Government in contemporary society - in economic development; the framework of Government; channels of political action; central and local government; the civil service and its organization. Bibliography.

The aim of this short course is to give an insight into the problems of Government, how it works, and what it does apart from providing funds for the development of a hydro-electric scheme.

Chapter II: Economic Development

First principles; public and private sector; industrialization; land; capital; labour, organization, technology; balance of payments; foreign aid. Bibliography.

This is intended as a brief introduction to macro-economics, and discusses the position of the project in economic planning.

Chapter III: The Structure of Industry

Ownership and management of industry by government (federal and state), public companies, private companies, individuals, capital intensive and labour intensive industries; characteristics of service, process, manufacturing and construction industries. Bibliography.

Chapter IV: Principles of Management

Principles of Management; organization, the nature and purpose of organization, functional responsibility, responsibility and accountability, delegation, centralization and decentralization. Management control methods, work study, operations-research, market research, systems analysis, use of numerical data.

Labour relations and trade unions, collective bargaining and the joint agreement.

The engineer and the law; contracts, law in labour relations. Bibliography.

Chapter V: Engineering Economics

The promoters' interest, revenue producing works, non-revenue producing works, taxation, and rates. Finance, interest and redemption; capital and revenue, capital value of annual charges. Valuation, cost life, depreciation, maintenance, running costs, overheads. Decision-making. Bibliography.

Chapter VI: The Contract System in Civil Engineering

History of the contract system, effect of mechanization and specialization. The parties to a contract, promoters, engineers, contractors. The contract relationships. Conditions of contract. Types of contract and comparison of relative merits. Tendering, contract prices. Administration. Disputes. Bibliography.

Chapter VII: Elements of Engineering Construction

Quantitative and economic aspects of the unit operations of construction, earth moving, excavation and filling, cofferdams and timbering, form work and centering, pumping and dewatering, erection, concreting, precasting, prestressing, industrialized building; the design of temporary works; the use and performance of mechanical equipment.

Works organization; project planning, operational research technique, critical path analysis "programme evaluation and review technique" (PERT). Resource allocation. Bibliography.

Part II:

This consists of notes on the individual films.

The subjects dealt with in the first part of the manual are, of course, only outlines, but an essential feature is that they are introduced around a real situation. Meaningful teaching to students of such subjects dealing with human relationships outside of their own experience can be unclear and imperfectly understood. Reference to the manual even after graduation will help the pieces to fall into place.

The study of this project could probably extend over 15 weeks for about 4 hours per week at the beginning of the final year of the course, although individual films could be used much earlier in the course to supplement academic material.

As an appendix to the Manual there would be included a series of suggested problems related to the project and suitable for individual or group study. These projects would be developed in the context of the actual region where the students work. The problems would be supervised by members of staff and could extend over a further 15 weeks again for 4 hours per week.

Film Production and Costs

In producing the films, extensive use would be made of animated cartoon styles as well as sequences of actual construction. The cost of producing the eight films and manual is estimated to be approximately US.\$ 335,000.^{1/} Additional prints of films would be available for about US.\$ 200. The films are thus virtually indestructable.

Much of the material shown in the films would change little; certain design and construction techniques would be improved and these could be incorporated in later additions at a fraction of the original capital cost.

As an example of the effect on the cost of education, supposing such a series of films were produced for Anglophone Africa, the engineering schools presently established have a capacity - by no means yet filled - of about 2,000 graduates per year of which about 700 would be civil engineers. An approximate estimate of the sum expended on each graduate lies between US.\$ 9,000 and US.\$ 12,000. This figure includes the recurrent costs and an allowance for the amortization of buildings and equipment. An estimate of the annual cost of the film series and manual allowing for interest and amortization of the capital cost including prints, is approximately US.\$ 47,000. Divided over the full capacity of civil engineering graduates, this is less than 1 per cent of the total unit cost of training. If the films are used at 20 per cent capacity, the total cost per graduate is increased by only 4 per cent. This is quoted as an extra cost but it is quite likely that a more efficient use of academic staff would result in a net saving.

The scheme has been defined in the context of civil engineering and its cost assessed in terms of Anglophone Africa, mainly because specific arguments show greater strength than generalities. But it is not intended only for civil engineering in Anglophone Africa. The techniques could apply with equal advantage to electrical and mechanical engineering. Similarly, much of engineering practices and physical conditions may be incorporated as variations to the main theme by separate prints. Differences in language are easily overcome by dubbing. Indeed, such a teaching device can be of value in industrialized countries.

Perhaps the greatest weakness of the scheme lies in its passivity. However, it is certainly no more passive than the traditional lecture or reading of a book. Problem solving based on local conditions can provide the complement, but the adequate solution of a problem without a background knowledge, even passively obtained, of what has been done before in similar circumstances, is hardly possible. The films and manual can effectively provide that background.

^{1/} 1973 costs.

HONDURAS: TRAINING CENTRES FOR RURAL DEVELOPMENT

by

T. Ramos Saco

HONDURAS: TRAINING CENTRES FOR RURAL DEVELOPMENT

Introduction

It is easy to make a plea for more non-formal education in rural areas. The real problem, as always, is how to put this idea into practice. The present note provides an illustration of this difficulty. The data are based on the work of Unesco's Project Identification and Project Preparation Missions which visited Honduras under the Co-operative Programme Unesco/IBRD, during July/August 1971 and February 1973 respectively.

Background

Honduras is a Central American country with a total estimated population in 1970 of approximately 2.5 million and an estimated density of 23 persons per sq.km. Nearly 73 per cent of the population is rural and the majority earn their living from agriculture which, as in most developing countries, is the backbone of the economy and the main source of foreign currency earnings.

Social and economic development problems are, of course, manifold, and include areas such as: infrastructure (physical and social), organization, services and financing. Those affecting education are of paramount importance. For example, illiteracy is high, particularly in the rural areas. According to the latest census (1961), 64 per cent of farmers had never attended school, and 24 per cent had not completed primary education. The opportunities offered to rural children to gain access to formal education and to complete the primary level are much less compared to those in the urban sector. The apparent participation rate in the former is 62 per cent against 144^{1/} in the latter. Ninety-nine per cent of incomplete schools not reaching 6th grade are in the rural areas; and unqualified teachers are concentrated in these areas. The quality of education in rural areas is thus low, as is the output/input ratio of primary schools (about 10 per cent).

The large majority of farmers are subsistence or small farmers whose skills are relatively primitive. Agricultural production, productivity and income are, therefore, low. Extension education provided by Government has inadequate coverage, and a large proportion of farmers have no skill, training or advice on modern farming techniques.

The Government, and some private organizations operate various non-formal educational programmes aimed at ameliorating the massive problem of the uneducated population. For example, literacy and adult primary education programmes have been developed by the Ministry of Education; radio and broadcast programmes by the Catholic Church for improving the general background of education; other programmes are operated by social groups and the University. The extension services referred to above operate a centre for the training of farmers, while another centre under the National Institute of Agriculture provides training for the Government cadre, community leaders and farmers on matters concerning agrarian reform and its implementation. In general terms, non-formal programmes touch only a small fraction of the rural population, and are often weak and unco-ordinated.

^{1/} Includes over-aged students.

Under these circumstances, non-formal education in its broadest sense, has a wide role to play in Honduras. Improvement of the quality and management of formal education in rural areas and the broadening of opportunities for access to education for rural children are prerequisites for development. These measures, however, are expected to have a long-term impact. Programmes aimed at more immediate results are, thus, necessary through the development of non-formal education and training.

The Government has assigned top priority to human resource development, rural development, and agrarian reform, and it aims at increasing agricultural productivity. Extension and agricultural research services will be strengthened and expanded to help achieve this end.

Concept of the Centres

An analysis was made of the main on-going non-formal education programmes for rural development, wherein objectives, scope, coverage, methods, and the strength and weakness of the programmes were examined. Information on costs was unavailable in most cases. The study was the starting point and basis for a proposal which recommends to the Government the establishment of Training Centres for Rural Development.

The broad goals aim at contributing to a higher standard of living and earnings for the rural population and also comply, concurrently, with the development objectives set by the Government.

According to these objectives, the main emphasis of any suggested programme should be focused on training activities related to the improvement of farming skills and matters pertinent to agrarian reform. This agrarian reform would not only contribute to another Government objective - the better distribution of income - but it is expected to stimulate farmers towards increased productivity and earnings which, in turn, would enable them to achieve their social demands. The objectives of a better standard of living and earnings were also scrutinized from the education point of view.

Experience has shown that the input of education alone does not increase farm production if other inputs such as financial aid, fertilizers, better seeds, etc. are not made available. Thus, the first step is to educate farmers about existing sources of information and in the procedures required to obtain these inputs, e.g. agricultural bank credit, Government and other agencies' supporting services. The second step is to develop the education programme to serve such areas that Government planning has already identified as priority areas for agricultural development, and where it is most likely that Government's efforts would provide for such services.

Experience has also shown that increased production by farmers does not necessarily mean that they benefit from higher earnings. One way of helping is to advise farmers to become members of co-operative movements - production, storage and marketing - with the idea of reducing costs and making the farmers the direct beneficiaries of their own efforts. Education can do a great deal in this direction, and also to make farmers aware of their rights and their

responsibilities as members of labour unions and society as a whole. It is thus necessary that the new education programme should include topics which will, in summary, prepare farmers for a more direct participation in the modern economy, and inform them about the advantages offered by new technology, and the sources from which to acquire this information, e.g. extension services, radio broadcast programmes, etc.

A new programme could not be of a comprehensive nature unless a balance is attained by introducing elements of training directly beneficial to the social aspects of life. For example, (i) the role of the rural woman for the betterment of family life has been under-estimated in Honduras. This occurs, in spite of the decisive role a woman plays in running a household, rearing children and molding their futures. Education is an important factor in this respect and should thus be considered in a new program; (ii) the need to facilitate development of programmes to raise the level of basic education in the family, e.g. literacy and radio broadcast programmes; (iii) the need to stimulate the spirit of enterprise, competition and citizenship in rural youth, and to equip them as potential future farmers with the general concepts and techniques for modern farming; (iv) the need to motivate the rural community towards self-help in development.

An examination of training potential for rural development leads to the conclusion that several on-going programmes could be mutually strengthened by proper co-ordination and consolidation, if new training programmes were built on the basis of the existing Centres referred to above, and on-going programmes - non-formal and formal aiming at similar objectives - were properly co-ordinated.

It is also considered of extreme importance for the success of the new programmes that the Centres should take into prime consideration the wishes of the rural community. To this end, the organization of the Centres will include participation of the community represented at national and local levels. The community will have not only direct participation in selecting the topics for training but, also, first-hand choice in selecting participants for the training programmes. Thus, one of the characteristics of the Centres will be their flexibility to cover a wide range of training programmes and a diversified clientele (men, women and youth, employed or to be employed, and with or without previous formal schooling).

A further correlation of the Centres' programmes with those for rural development, in addition to their location and physical attachment to programmes of this nature, will be ensured by the organization of the Centres, in which agencies engaged in rural development, (public, semi-public and private) will have a strong hand in molding the Centres' decisions for programme planning and implementation.

The Centres will include a built-in mechanism for field evaluation of the training programmes, where the extension services will have a major responsibility.

In brief, the proposed Training Centres for Rural Development will be non-formal, multi-purpose, flexible training units aimed at improving the knowledge and skills of the rural population (mainly agricultural) for social and economic development, wherein measures and mechanisms will be established to comply with Government guidelines for development, and with the wishes and active participation of the rural community.

Proposals for Organization, Administration and Programmes

The two existing Centres referred to above will be incorporated into a national chain of five Training Centres - including three new ones to be established.

Co-ordination amongst Centres will be facilitated by the appointment of a "Co-ordinator for the Project" who will chair an Ad-Hoc Co-ordinating Committee at national level. Represented on this Committee will be the main public, semi-public and private organizations engaged in rural development activities, as well as the rural community through the Federation of Peasants League. The Committee will study the proposals advanced by the local committees, and will co-ordinate the support required to implement the programmes on a national level. The local committee attached to each Centre will have a representation analogous to that of the National Committee. The Committees for Rural Development soon to be established under Government auspices in different regions of the country, and the Associations of Peasants and the Local Units of the Federation of Peasants League, will represent the rural community on the local committees of the Centres. The local committee's main functions will be to prepare, well in advance, the agenda for the training programmes and activities of the Centre, and to co-ordinate the physical, human and financial elements that may be required for programme implementation. Whenever any special support outside the local committee's capability is required, e.g. staff, facilities, financing of services, the local committee will request such support from the National Committee.

The Head of each Centre will act as Executive Secretary of the local committee and be in charge of programme implementation. The Government has decided that, provisionally, two of the Centres will be operated under the administrative and financial responsibility of the Ministry of National Resources (Extension Department), and two under the National Agrarian Institute (in charge of agrarian reform). This does not entail that the Centres' activities will be restricted to those falling under the responsibility of their respective administration.

In principle, all courses will be short (one to two weeks) and the Centres will provide residential facilities for the trainees and for a certain number of staff. Because of the flexible nature of the Centres, it is not possible to anticipate exactly the type of training courses and topics to be offered. It is envisaged, however, that as a first approximation all or some of the following types of courses and activities will be included (the name in brackets denotes that of the responsible agency):

- (i) Agricultural Production Techniques (Ministry of Natural Resources);
- (ii) Livestock Development (Ministry of Natural Resources);
- (iii) Agrarian Reform (National Agrarian Institute);
- (iv) Co-operatives (National Agrarian Institute and Ministry of Natural Resources - Directorate for Co-operative Promotion);
- (v) Home Improvement (Ministries of Natural Resources and Public Health);
- (vi) Organization of Labour Unions (National Federation of Farmers of Honduras);
- (vii) Training of Monitors for Radio Broadcast Programmes (Radiophonic Schools Organization);
- (viii) Training of Voluntary Leaders for Rural Development (Ministry of Natural Resources);
- (ix) Agricultural Credit; Storage and Marketing of Agricultural Products (National Agricultural Bank);
- (x) Training of Leaders for 4-S Clubs (Ministry of Natural Resources);
- (xi) Trade Training (INFOP);
- (xii) Training of Voluntary Leaders for Self-Help Community Development (National Welfare Committee);
- (xiii) Communication (Ministry of Natural Resources);
- (xiv) Field Practice Training for the Training of Adult Education Instructors (Ministry of Education).

Those topics related to agriculture and livestock development will be of a specific nature, and related to the needs of the corresponding area, e.g. African palm is being introduced as a new crop in the Aguan Valley where one of the Centres will be located, and will be a main subject of training in that Centre.

The permanent staff of the Centre will consist basically of two experienced and high-level professionals, or sub-professionals, who will most likely be in a position to handle a large part of the training activities of the Centre. One of them will be the Head of the Centre. However, depending upon the nature and level of the course, additional supporting staff will be necessary. To this end, institutions engaged in rural development - such as those indicated in the previous paragraph between brackets, and most likely represented on the Co-ordinating Committees - will be called upon to take full responsibility for some of the courses or to provide support for others.

In a first phase, priority will be assigned to the training of the professional and technical cadre required for implementing programmes on extension and agrarian reform, and for the personnel to be in charge of the new Centres to be established. The existing Centres already have facilities for such purposes and one of them (Comayagua) is better adapted for extension training, whereas the

other (Guanchias) is better suited for agrarian reform. In a second phase, the Centres will concentrate their major activities on the training of leaders. In a third phase, the Centres will initiate direct training of the basic rural population. This order of priority, however, should not be taken as rigid. The extension of services will co-ordinate field activities with the Centre's programmes and will provide support to leaders and farmers trained at the Centres.

All Centres will be provided with residential facilities for groups of 30 trainees and staff, with instructional facilities (auditorium, laboratory/workshops for training rural women, staff reference library) and communal services. Furniture and equipment will also be provided. As the Centres will be attached to on-going rural development programmes, some of the physical facilities required for the course will be obtained from these programmes. Transportation for field trips will also be made available to the Centres. It is expected that each Centre will provide training for approximately 1,200 trainees per year, or a total of 6,000 between the five Centres.

External technical assistance has been included for overall organization and development of the programmes of the Training Centres. This assistance will be a part of technical assistance for a broader programme on agrarian reform and training.

Costs

The capital cost per Centre for 30 trainees averaged in Honduras US.\$ 157.7 thousand (\$ 127.5 thousand for building construction and \$ 30.2 thousand for furniture, equipment and transport). As it is estimated that 1,200 trainees will be trained per year at each Centre, the capital cost per trainee for a one-week course (of 5.5 days of actual training) would be US.\$ 5.06 ^{1/}.

The annual recurrent cost was estimated in Honduras at an average of US.\$ 42.7 thousand for each of three new Centres to be developed, or approximately US.\$ 32.61 per trainee for a one-week training course (of 5.5 days of actual training). This cost includes expenses such as administration, salaries of permanent staff, transport and per diem for visiting staff, meals and lodging for trainees, maintenance, utilities, materials and transport.

It will be noticed from the foregoing that total training cost (capital and recurrent) could be estimated at about US.\$ 37.67 per trainee for a one-week course (5.5 days of actual training); this is an average cost that includes the training or retraining not only of farmers, but of the professional cadre, middle-level technicians, and leaders (some of them voluntary) for rural development and self-help programmes, as well as monitors for radio broadcast programmes. The benefits of the training of some of these groups will have a multiplying effect on new untrained farmers, or a supporting effect on those already trained at the Centres. This will possibly reduce the cost per farmer trained, on an overall basis.

^{1/} Assuming 240 days of actual training during a calendar year, and that the Centres' building would be utilized for 20 years and furniture and equipment for 10 years.

If a comparison of costs should be made with other programmes, these should pursue objectives similar to those of the Centres. However, no other programmes are available for comparison in view of the multi-purpose nature of the Centres and the various types of clientele to which the programmes are addressed. Furthermore, in view of the fact that some important benefits from the programmes of the Training Centres are not primarily economic in character, but social and political as well, the application of a cost/benefits approach is virtually impossible.

Conclusion

It will be clear from this brief description that it is virtually impossible to standardize patterns for rural education. Programmes have to be adapted to local conditions. The main reason is that a large number of non-educational variables have to be taken into consideration. These include, inter alia, possibilities of agricultural development, opportunity for farmers to reap the benefits of increased production, Government organization and administration, Government economic policy and, above all, the desire of rural communities to improve their lot.

THE DESIGN AND COSTING OF WORKSHOPS FOR TEACHER TRAINING COLLEGES

by

R. AuJame

THE DESIGN AND COSTING OF WORKSHOPS FOR TEACHER TRAINING COLLEGES

In many countries the training programme for teachers includes training in a number of practical skills such as wood work, metal work, arts and crafts. This involves the establishment of one or several workshops at new teacher training institutions, or the addition of such workshops to existing teacher training colleges, or the creation of separate facilities in conjunction with the organization of in-service training courses for teachers.

The design and costing of these workshops often presents a practical difficulty. The educational authorities who decide that practical courses are to be included in a teacher training programme, usually take it for granted that the architects concerned (for example those in the Ministry of Public Works) know exactly what they have in mind, but in fact this is very seldom the case. Furthermore, educators often find it difficult to explain their proposals to architects. Thirdly, the Ministry of Finance usually has a say in the matter as well: at a minimum, they would like to know from the educators and/or the architects what the construction and equipment costs of such workshops are, and educators are often unable even to give approximate cost estimates.

It is to help solve problems of this kind that architects, educators and economists in the Educational Financing Division have together worked out a sketch design for workshops in teacher training colleges, together with rough cost estimates. It goes without saying that the cost data and the sketch designs provided in the present note are not intended to be copied as they now stand. In each country, and probably for each teacher training college, more precise designs and costs will be needed to take account of local conditions. Nevertheless, it is hoped that the present note will help educational planners and decision-makers clarify their ideas in terms of space, equipment and cost.

A discussion of the purpose and the curricula of these courses falls outside the scope of the present paper. However, certain assumptions had to be made regarding the curriculum. These are as follows:

- (a) it is assumed that teachers, or at least a number of teachers, will be trained as instructors in wood and metal work, or arts and crafts, or both;
- (b) it is further assumed that, as part of their training, all teachers will require some practice in manufacturing simple learning aids.

On the basis of these assumptions, the following spaces are suggested:

- | | | |
|----|-------------------------|---|
| A. | Wood and Metal Workshop | For 16 students (small unit) or 30-35 students (large unit). This is a normal workshop including benches with tools for 2 groups of 8 students each. One band saw and 1 drilling machine for carpentry work. Space for soldering and brazing (6 students) and 2 small machines, for metal work. Ample storage for tools and material. Instructor's desk and cupboard. |
| B. | Arts and Crafts Room | For 8 students (small unit) or 16 students (large unit). Includes space for art, drawing and pottery: tables, easels, water areas and storage, bench space for 8 students with 1 firing oven and 4 wheels. Instructor's desk and cupboard. Storage space. |
| C. | Aid-Making Workshop | For 8 students (small unit) or 16 students (large unit). Equipment includes work benches with tools for 8 students. Large table for model-making kits, charts, map printing, elementary wood cutting. Storage space. Instructor's desk and cupboard. |
| D. | Exhibition Area | Directly connected with A, B and C. To be used for the exhibition of the work carried out by each unit. Could be included in the circulation area. Also includes a book display cabinet with locks, to be used as reference library. |

The first three elements should be closely linked, with easy access to one another, particularly B and C. While discussion on the design as well as in the drafting of a proposed teaching aid takes place in the arts and crafts room, the group concerned might be able to move into C during the lesson and start production of the kit.

When carrying out the design of such workshops, the architects should take into consideration:

- the local climatic conditions; orientation of the building to receive (or to avoid) sun and breeze;
- the elements of comfort; efficient natural lighting; absence of reverberation effect, through ventilation and sun protection;
- the possibility of extension and/or alteration of each component;

- direct access to storage areas;
- the possible use of modular co-ordination.

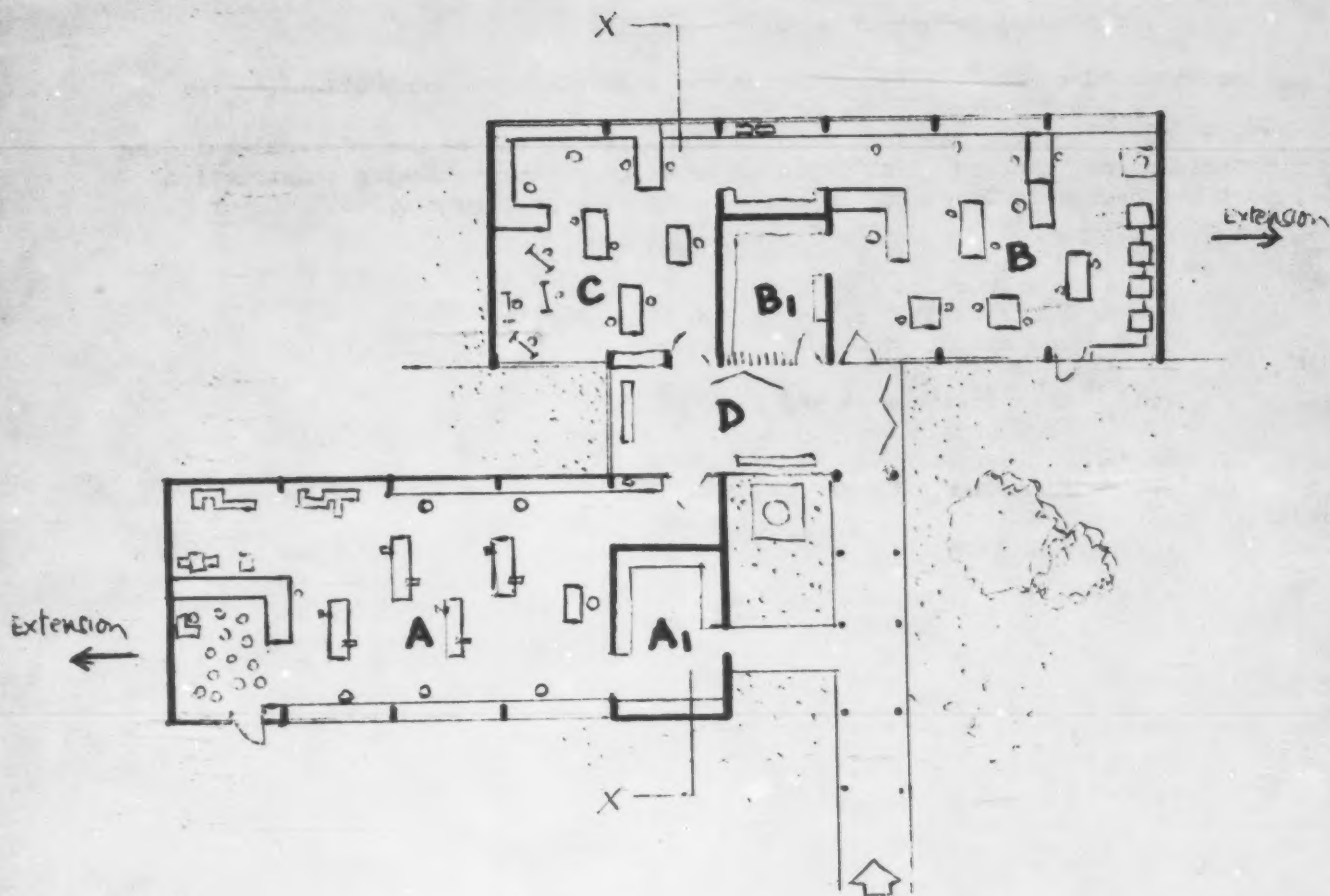
(See attached annex for sketch design and schedule of accommodation).

Considering a standard construction with extensive use of local building materials and improved local building techniques, the following construction cost has been calculated on the basis of an average figure of US.\$ 50 per sq.m.: 1/

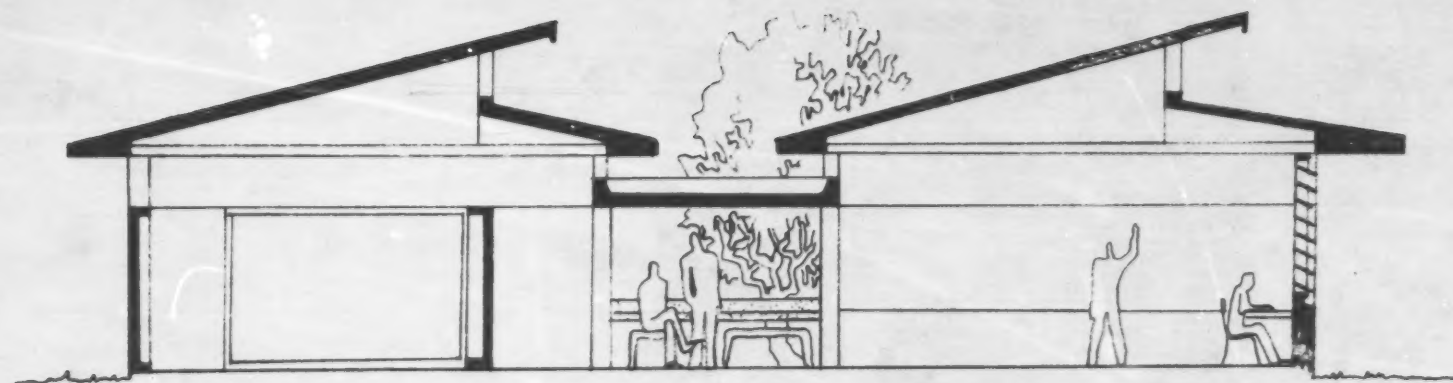
(i)	construction (small unit : 35 students), 272 x US.\$ 50 per sq.m., including wall and circulation	13,600
(ii)	site development and fees (20% of construction cost)	2,720
(iii)	furniture (10% of (i))	1,360
(iv)	equipment	6,000
Total		<u>US.\$ 23,680^{2/}</u>

1/ 1971 cost data.

2/ Under-estimate in light of 1975 prices.



Workshop Aid Centre (35 students)		Plan:scale 0.5 cm pm			
Item No.	Accommodation Units	Net area m ²	Number of places	m ² per place	
A	Wood and metal workshops	90	16	5.6	
A ₁	Storage	20			
B	Aid making workshop	68	8-10	6.8	
B ₁	Storage	12			
C	Craft and education room	48+9	8	6	
D	Exhibition area	25			
Total		272	32-35		



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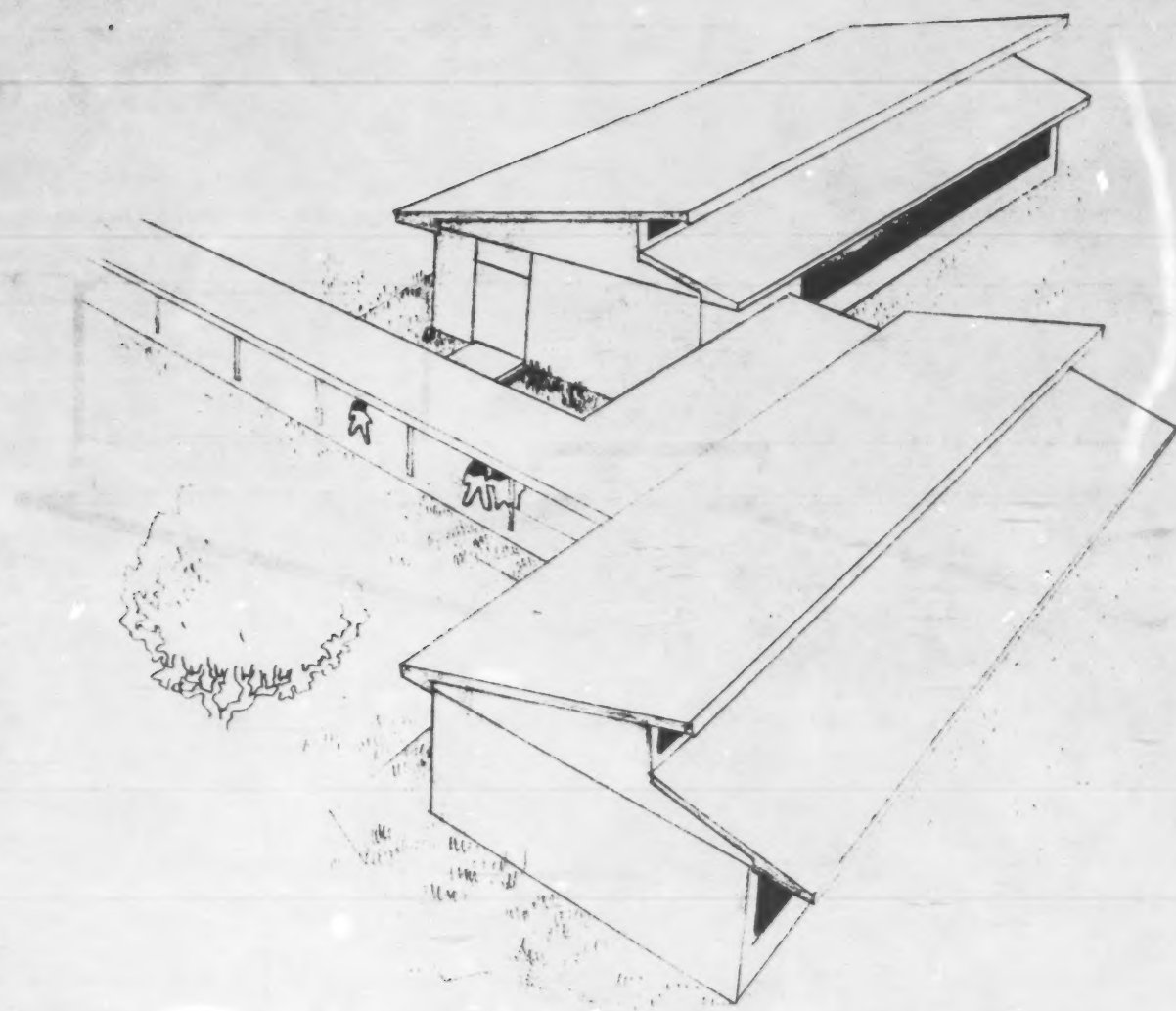
Workshop Aid Centre

Section X.X
Scale 1 cm pm

- 161 -

Drawing 2

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Workshop Aid Centre

Aerial view

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10

LES EFFETS DE LA POLITIQUE DE FORMATION DES MAITRES
ET DES CONSTRUCTIONS SCOLAIRES SUR LES COUTS UNITAIRES
DE FONCTIONNEMENT DE L'EDUCATION

par

L. Vu Cong
(avec la contribution de R. Ganeff)

LES EFFETS DE LA POLITIQUE DE FORMATION DES MAÎTRES
ET DES CONSTRUCTIONS SCOLAIRES SUR LES COÛTS UNITAIRES
DE FONCTIONNEMENT DE L'ÉDUCATION

Le développement de l'éducation de base se heurte dans beaucoup de pays, et particulièrement dans les pays en voie de développement, au coût élevé du fonctionnement de l'éducation. L'analyse rapide de ce problème met souvent en évidence le rôle joué par les salaires élevés des enseignants (par rapport notamment au revenu national par tête). Cependant, un autre facteur d'importance n'a pas été jusqu'à présent l'objet d'études approfondies : le "sous-emploi" des enseignants reflété par le faible ratio élèves/maître. Les causes en sont au moins au nombre de quatre : le curriculum et la répartition des horaires hebdomadaires des maîtres, la formation plus ou moins spécialisée des maîtres, la durée légale de l'horaire hebdomadaire quant aux charges d'enseignement, la dimension des établissements scolaires et la distribution de la carte scolaire. Il entre dans le cadre des activités de gestion d'un service de planification, de définir des mesures pratiques susceptibles de réduire les coûts unitaires de l'éducation. Il paraît ainsi intéressant de chercher à analyser dans quelques cas concrets les facteurs gouvernant le taux d'emploi des maîtres.

Le champ d'étude qu'on se propose de couvrir est l'enseignement du premier cycle du second degré, car ses effectifs augmentent rapidement dans la plupart des pays en voie de développement, et il tend à s'intégrer, avec l'enseignement primaire, dans une éducation de base dont le caractère universel et obligatoire est considéré dans certains de ces pays comme un objectif à atteindre au cours de la prochaine décennie. Par ailleurs, ce cycle d'enseignement possède les caractéristiques de l'enseignement secondaire du 2ème cycle, notamment la spécialisation des maîtres et partant, l'importance du coût unitaire de fonctionnement qui représente en moyenne 5 ou 6 fois celui de l'enseignement primaire. Cette première étude portera sur le Mali (structure du système d'éducation : 6-3-3) ; elle pourra s'étendre ultérieurement à d'autres pays.

Le premier cycle de l'enseignement du second degré au Mali (ou plus exactement le 2ème cycle de l'enseignement fondamental) avait en 1970/71 26.112 élèves et 1.528 maîtres, soit un ratio moyen élèves/maître de 17. Ce ratio déjà faible ne reflète pourtant pas entièrement la réalité, puisque, dans de nombreux établissements, certaines matières ne sont pas enseignées du tout ou ne le sont que partiellement, faute de maîtres. En d'autres termes, un nombre sensiblement plus élevé de maîtres serait nécessaire pour appliquer intégralement le programme d'études dans tous les établissements, ce qui entraînerait un ratio élèves/maître beaucoup plus faible encore. Pour mettre en évidence l'effet de la taille des écoles (nombre de classes) sur les besoins en maîtres, les calculs ont été effectués successivement pour une école de : 3 classes (1 classe de 1ère année, 1 classe de 2ème année, 1 classe de 3ème année), 6 classes (2 classes de 1ère année....), 9 classes (3 classes de 1ère année.....), 12 puis 15 et 18 classes. Ces catégories n'ont pas été choisies arbitrairement : ce sont celles qui existent dans ce cycle d'enseignement au Mali en 1970/71 (Tableau 1).

TABLEAU 1

Type d'école	Nombre de classes						Total
	3	6	9	12	15	18	
Nombre d'écoles	71	30	17	17	2	2	139
Nombre de classes	213	180	153	204	30	36	816

L'annexe I résume de façon synthétique les horaires hebdomadaires par discipline et par type d'école. L'annexe II donne (i) les horaires hebdomadaires par disciplines "regroupées" selon la formation actuelle des maîtres, et par type d'école, et (ii) le nombre de maîtres nécessaires par type d'école.

A partir du nombre de maîtres nécessaires pour mener à bien le programme d'enseignement par type d'école et du nombre d'écoles correspondant à chacun des types indiqués plus haut, il est possible de calculer le nombre total de maîtres nécessaires en 1970/71 (Tableau 2).

TABLEAU 2

Type d'école	Nombre de classes						Total
	3	6	9	12	15	18	
Nombre de maîtres nécessaires par type d'école	8	12	15	17	24	28	
Nombre d'écoles	71	30	17	17	2	2	139
Nombre de maîtres nécessaires	568	360	255	289	48	56	1.576

Ainsi, pour mener à bien le programme d'enseignement, il aurait fallu disposer de 1.576 maîtres (ratio élèves/maître : 16), ce qui constitue d'ailleurs un minimum car dans la pratique, à moins d'avoir un système de gestion très avancé, le stock de personnel enseignant nécessaire s'avère toujours plus important que le nombre calculé théoriquement.

Nous allons essayer d'apprécier l'importance respective de deux des facteurs du "taux d'emploi" des maîtres, déjà mentionnés au début de cette note : leur degré de polyvalence et la dimension des établissements scolaires. L'annexe II montre le cumul de différentes disciplines donnant lieu à 8 catégories de maîtres dans le système que le Mali se propose de mettre en œuvre. Indépendamment des questions de politique éducative qui se poseront au niveau de l'enseignement moyen et de

la formation de son personnel enseignant, une polyvalence plus marquée du corps professoral pourrait être conçue sur la base d'une formation en 4 sections :

- lettres (français, éducation civique) ;
- langues, musique, dessin ;
- mathématiques, physique, chimie ;
- sciences naturelles, géographie, histoire.

L'annexe III montre que les catégories de maîtres dans ce cas se réduisent à 7 et le nombre total de maîtres nécessaires ressort à 1.473 enseignants.

Dans l'hypothèse de l'adoption d'une nouvelle structure, prolongeant le primaire de manière à offrir une éducation de base de 9 à 10 ans à une proportion d'enfants de plus en plus grande, on peut imaginer une moindre spécialisation des maîtres enseignant dans les années d'études 7 à 9 (ou 10). Ceci aurait pour effet d'avoir une intégration plus effective de l'enseignement des diverses disciplines ou au moins une plus grande coordination. On pourrait concevoir deux types de maîtres de matières théoriques : le maître à orientation littéraire et le maître à orientation scientifique. Les premiers seraient chargés, par exemple, de l'éducation civique et de l'histoire tandis que leurs collègues scientifiques auraient, en plus des branches scientifiques et des mathématiques, l'enseignement de la géographie et (ou) de la technologie élémentaire et l'éducation physique. La musique et le dessin seraient enseignés par un seul maître. Il y aurait donc 3 types ou catégories de maîtres (annexe IV) et le nombre total de maîtres nécessaires serait de 1.187.

A titre de référence, il est possible de calculer le nombre de maîtres nécessaires dans le cas d'une "polyvalence parfaite". Il suffit de connaître le total des charges hebdomadaire d'enseignement, exprimé en heures, et la durée légale de l'horaire hebdomadaires d'enseignement qui est dans le cas présent de 24 heures. Le tableau ci-après indique les charges hebdomadaires d'enseignement par type d'école et pour l'ensemble des 139 écoles.

Type d'école	Nombre de classes						Total
	3	6	9	12	15	18	
Nombre d'écoles	71	30	17	17	2	2	139
Charges d'enseignement hebdomadaires (heures)	102	204	306	408	510	612	
Charges totales d'enseignement (heures)	7.242	6.120	5.202	6.936	1.020	1.224	27.744

Les 27.744 heures d'enseignement hebdomadaire peuvent donc théoriquement être assumées, dans le cas d'une polyvalence parfaite des maîtres par : $27.744/24 = 1.156$ maîtres. Il s'agit évidemment d'un calcul théorique dont le but est uniquement de montrer l'ordre de grandeur des économies possibles qui sont ici d'environ 36 %.

Il résulterait sans doute des différentes formules précédentes de formation des maîtres, des économies considérables. Dans la pratique, il ne serait probablement pas possible ni souhaitable de rendre aussi rigides les classifications en différentes catégories de maîtres. Une plus grande flexibilité dans le choix des matières devrait pouvoir être donnée aux élèves-maîtres afin qu'ils éprouvent un réel intérêt pour les sujets qu'ils auront par la suite la charge d'enseigner. On pourrait par exemple envisager qu'un grand nombre d'options soient offertes aux élèves-maîtres qui pourront alors, indépendamment des sections de formation envisagées précédemment, choisir deux matières principales et une matière secondaire. Par la suite, ils seront appelés normalement à enseigner dans leur matière principales avec la possibilité d'enseigner également dans leur matière secondaire. Ceci requiert à l'évidence une organisation beaucoup plus complexe au niveau de la formation des maîtres et enfin la gestion du personnel enseignant ainsi formé ne pourrait être menée à bien que dans le cadre d'une administration parfaitement compétente, souple et décentralisée.

Il est également à noter que dans les zones urbaines tout au moins, une autre façon de réaliser des économies (aussi bien en ce qui concerne les constructions et l'équipement que l'utilisation plus rationnelle des maîtres) consisterait à grouper l'enseignement des matières pratiques (science, technologie élémentaire, musique, dessin, éducation physique) dans des "blocs" spécialisés qui desserviraient plusieurs écoles.

En supposant maintenant que le système scolaire comporte une structure unique d'écoles à 12 classes - ce type d'école paraissant être le type le plus "économique" compte tenu du curriculum actuel - on obtiendra au total 68 écoles, soit 816 classes pour accueillir les 26.112 élèves. L'annexe II indique un nombre de 17 maîtres pour ce type d'école, ce qui donne au total : $68 \times 17 = 1.156$ maîtres. L'économie obtenue en nombre de maîtres serait d'environ 36 %, soit la même que dans le cas précédent de la polyvalence parfaite. Le ratio élèves/maître passerait dans ce cas de 16 à 22. Dans la pratique, si une telle décision était prise, à savoir un remodelage complet de la carte scolaire, la capacité moyenne de la classe n'aurait pas de raison d'être limitée à 32 élèves^{1/}. En fait, pour les nouvelles écoles à construire, une capacité par classe de 40 élèves a été adoptée. En reprenant les calculs sur cette base, le système devra comprendre 55 écoles à 12 classes, ce qui donnera 935 maîtres, soit pour 26.400 élèves ($12 \text{ classes} \times 40 \text{ élèves} \times 55 \text{ écoles}$) un ratio élèves/maître de 28.

Il est possible à présent de définir les avantages financiers de chacune des alternatives précédentes.

Alternative I : situation actuelle de référence (1970/71) correspondant à 1.576 maîtres pour mener à bien le programme d'études. Le coût unitaire est de 55.000 francs maliens dont 46.500 de salaires du personnel enseignant et 8.500 pour les autres dépenses de fonctionnement. Le ratio élèves/maître est de 16.

^{1/} 26.112 élèves pour 816 classes, soit une capacité moyenne de 32 élèves par classe.

Alternative II : le nombre de catégories de maîtres passera de 8 à 7. Le nombre de maîtres nécessaires sera égal à 1.473. Les effectifs d'élèves étant toujours de 26.112, le ratio élèves/maître sera de 18. Le coût unitaire de dépenses en personnel enseignant sera de 43.500 FM. Cette alternative impliquera une légère réforme de la formation des maîtres mais aucune dépense d'investissement ou d'assistance technique ne sera nécessaire. La réalisation pourra être prévue dans le court terme.

Alternative III : les catégories de maîtres seront de 3. Le nombre de maîtres nécessaires sera de 1.187, le ratio élèves/maître de 22. Le coût unitaire de dépenses en personnel enseignant sera de 35.000 FM. Cette alternative impliquera une grande réforme de l'enseignement normal. L'assistance technique sera sans doute nécessaire. La réalisation de cette alternative ne pourra être prévue qu'à moyen terme et impliquera une amélioration de l'administration et de la gestion du personnel enseignant.

Alternative IV : il s'agira de remodeler la carte scolaire pour obtenir un système unique d'écoles à 12 classes avec une capacité moyenne de 40 élèves par classe. 55 écoles totalisant 660 classes pourront dans ce cas accueillir 26.400 élèves. Rien n'étant changé dans la formation des maîtres, le nombre de maîtres nécessaires sera comme dans la situation de référence, de 17 par école, soit au total 935 maîtres. Le ratio élèves/maître sera donc de 28 et le coût unitaire de dépenses en personnel enseignant de 27.300 FM. Cette alternative ne pourra être envisagée que dans le cadre d'une politique d'ensemble de remodelage de la carte scolaire. Sa réalisation ne pourra être prévue qu'à long terme et impliquera d'importants investissements.

Alternative V : il s'agira de combiner l'alternative III (3 catégories de maîtres) avec l'alternative IV (écoles à 12 classes de 40 élèves). Le nombre de maîtres nécessaires (16 par école pour 55 écoles) sera de 880, ce qui donne pour 26.400 élèves, un ratio élèves/maître de 30. Le coût unitaire de dépenses en personnel enseignant sera de 25.700 FM. Cette alternative nécessitera à la fois des dépenses d'assistance technique et des dépenses d'investissement. Sa réalisation devra être prévue dans le cadre d'une programmation à long terme.

Le tableau 3 résume les incidences financières de ces alternatives sur le coût unitaire. Les économies pourraient être de l'ordre de 20 à 35 %.

TABEAU 3

Alternatives	Nature des travaux et des dépenses	Terme de réalisation	Incidences sur les coûts récurrents unitaires (en francs maliens)				
			Ratio élèves/maître	Dépenses en personnel enseignant	Autres dépenses	Total	Indice
<u>Alternative I</u> Situation de référence : 1/ .8 catégories de maîtres			16	46.500	8.500	55.000	100
<u>Alternative II</u> .7 catégories de maîtres	légère réforme de l'enseignement normal	court terme	18	43.500	8.500	52.000	94,5
<u>Alternative III</u> .3 catégories de maîtres	réforme de l'enseignement normal dépenses d'assistance technique	moyen terme	22	35.000	8.500	43.500	79,0
<u>Alternative IV</u> .8 catégories de maîtres .Système d'écoles à 12 classes de 40 élèves ^{2/}	dépenses d'investissement	long terme	28	27.300	8.500	35.800	65,0
<u>Alternative V</u> .3 catégories de maîtres .Système d'écoles à 12 classes de 40 élèves	dépenses d'assistance technique et d'investissement	moyen et long terme	30	25.700	8.500	34.200	62,0

1/ 1970/71.

2/ Au lieu de 32 actuellement.

En fait, loin de s'exclure, les alternatives précédentes pourraient être intégrées dans la programmation d'une stratégie globale à long terme. Il peut être concevable dans l'immédiat d'appliquer l'alternative II et de mettre à l'étude les conditions de mise en oeuvre des alternatives III et V qui seront réalisées respectivement à moyen et à long terme. Seule se trouve exclue l'alternative IV qui a été présentée pour "isoler" les effets d'un remodelage de la taille des écoles.

Une difficulté spécifique peut cependant s'opposer à la réalisation de l'alternative V, à savoir la dispersion de l'habitat. Dans ce cas, l'analyse précédente sera tout à fait nécessaire en ce sens qu'il pourra être démontré que l'implantation des écoles de taille rentable comportant soit un internat, soit des équipements de cantine (pour combattre la difficulté évoquée précédemment) sera justifiée par la marge considérable d'économies dégagées sur les salaires des maîtres. Cette démarche devrait donc compléter l'approche traditionnelle qui consiste souvent, par mesure d'économie, à supprimer les dépenses dites sociales (entretien des élèves, etc.), sans chercher à analyser les causes plus profondes que sont le mode d'emploi des maîtres ainsi que la structure et la distribution de la carte scolaire. En termes d'analyse socio-économique plus globale, l'approche traditionnelle pourra ainsi aboutir à des gaspillages, donc à des coûts sociaux plus élevés^{1/}, sans compter les "coûts d'opportunité" représentés par un meilleur recrutement des maîtres basé sur des salaires plus attractifs, ainsi que par une amélioration de la qualité de l'enseignement basée sur des dépenses de fonctionnement plus importantes. Il convient d'ajouter enfin que les éléments analysés dans cette note devraient être pris en considération, dans une politique de remodelage de la carte scolaire, en termes d'analyse coût-bénéfice.

1/ Que l'entretien des élèves soit assuré par l'école ou par les parents, au niveau global des coûts sociaux, le résultat est le même ; néanmoins, dans le cas d'une "mauvaise" structure de la carte scolaire, la charge sociale d'entretien des élèves incombe aux parents mais il reste le gaspillage dû au mauvais emploi des maîtres.

ANNEXE I

HORAIRE HEEDOMADAIRE PAR MATIERE ET PAR TYPE D'ECOLE

Matières	Type d'école (nombre de classes)					
	3	6	9	12	15	18
Mathématiques	15	30	45	60	75	90
Sciences physiques	6,5	13	19,5	26	32,5	39
Sciences naturelles	6	12	18	24	30	36
Initiation technologique	6	12	18	24	30	36
Enseignement ménager	6	12	18	24	30	36
Histoire	4,5	9	13,5	18	22,5	27
Géographie	4,5	9	13,5	18	22,5	27
Français	18	36	54	72	90	108
Dessin	3	6	9	12	15	18
Education musicale	3	6	9	12	15	18
Education civique et morale	3	6	9	12	15	18
Education physique	6	12	18	24	30	36
Etudes surveillées	6,5	13	19,5	26	32,5	39
Langue vivante (anglais)	14	28	42	56	70	84
Total	102,0	204	306,0	408	510,0	612

ANNEXE II

NOMBRE DE MAÎTRES NECESSAIRES PAR TYPE D'ECOLE
(8 catégories de maîtres)

Matières	Type d'école (nombre de classes)											
	3		6		9		12		15		18	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Mathématiques, physique	21,5	1	43	2	64,5	3	86	4	107,5	5	129	6
Histoire géographique, sciences naturelles, éducation civique	18	1	36	2	54	3	72	3	90	4	108	5
Initiation technologique	6	1	12	1	18	1	24	1	30	2	36	2
Enseignement ménager	6	1	12	1	18	1	24	1	30	2	36	2
Education physique	6	1	12	1	18	1	24	1	30	2	36	2
Français	18	1	36	2	54	3	72	3	90	4	108	5
Langue vivante (anglais)	14	1	28	2	42	2	56	3	70	3	84	4
Matières spéciales	6	1	12	1	18	1	24	1	30	2	36	2
Etudes surveillées (c)	6,5	pm	13	pm	19,5	pm	26	pm	32,5	pm	39	pm
	(d)											
Total	102,0	8	204	12	206,0	15	408	17	510,0	24	612	28

(a) Horaire hebdomadaire.

(b) Nombre de maîtres.

(c) Les études surveillées sont assurées par les maîtres ayant des heures disponibles.

(d) pm = Pour mémoire.

Note : Durée hebdomadaire légale d'enseignement = 24 heures.
Nombre d'élèves par classe = 32.

ANNEXE III

NOMBRE DE MAÎTRES REQUIS PAR TYPE D'ÉCOLE
(7 catégories de maîtres)

Matières	Type d'école (nombre de classes)											
	3		6		9		12		15		18	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Français, éducation civique	18	1	36	2	54	3	72	3	90	4	108	5
Langues vivantes, musique, dessin	20	1	40	2	60	3	80	4	100	5	120	5
Mathématiques, physique, chimie	21,5	1	43	2	64,5	3	86	4	107,5	5	129	6
Sciences naturelles, géographie, histoire	18	1	36	2	54	3	72	3	90	4	108	5
Education physique	6	1	12	1	18	1	24	1	30	2	36	2
Etudes surveillées	6,5	pm (c)	13	pm	19,5	pm	26	pm	32,5	pm	39	pm
Initiation technologique	6	1	12	1	18	1	24	1	30	2	36	2
Enseignement ménager	6	1	12	1	18	1	24	1	30	2	36	2
Total	102,0	7	204	11	306,0	15	408	17	510,0	24	612	27

(a) Horaire hebdomadaire.

(b) Nombre de maîtres.

(c) pm = Pour mémoire.

ANNEXE IV

NOMBRE DE MAÎTRES REQUIS PAR TYPE D'ÉCOLE

(3 catégories de maîtres)

Matières	Type d'école (nombre de classes)											
	3		6		9		12		15		18	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Français, éducation civique, langues vivantes, histoire	39,5	2	79	4	118	5	158	7	197,5	9	237	10
Mathématiques, physique, chimie, sciences naturelles, géographie, technologie ^{1/} , éducation physique	44	2	88	4	132	6	176	8	220	9	264	11
Musique, dessin	6	1	12	1	18	1	24	1	30	2	36	2
Etudes surveillées	6,5	pm ^{2/}	13	pm	19,5	pm	26	pm	32,5	pm	39	pm
Total	96,0	5	192	9	288,0	12	384	16	480,0	20	576	23

(a) Horaire hebdomadaire.

(b) Nombre de maîtres.

^{1/} Pour garçons et filles.

^{2/} pm = Pour mémoire.

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VETERINARY SERVICES
AND THE TRAINING OF ANIMAL HEALTH ASSISTANTS

by

T. Ramos Saco

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VETERINARY SERVICES
AND THE TRAINING OF ANIMAL HEALTH ASSISTANTS

Introduction

The economic and social importance of livestock often is not clearly identified in discussion about agriculture and rural development in developing countries. The tendency is to focus on the development of crops, although there are many countries where the condition of the livestock sub-sector might require equal, if not greater priority attention. In these countries, the agricultural education and training programme may need to be revised in order to give a more appropriate emphasis to animal husbandry and veterinary science, and to permit adequate staffing of the veterinary services.

The Requirement for Veterinary Services

The "World Food Problem Proposals for National and International Action" prepared by FAO as an item of the agenda to the recent World Food Conference^{1/} state clearly the urgent need for increasing world output of the group of animal protein commodities provided by the livestock industry and fisheries. Shortage of animal protein is a common cause of malnutrition in developing countries, and the brain damage caused by inadequate protein intake by the mother during pregnancy and by the child during early life may result in irreparable consequences in the child's future life and his ability to learn.

^{2/} The Indicative World Plan for Agricultural Development (IWP) prepared by FAO, has set target rates of growth of output of livestock products for the period 1962-1985 that are considered feasible in the light of expected growth of demand and the anticipated potentialities and constraints identified in the developing countries. The growth rates considered feasible for the developing world as a whole were: ruminant meat, 2.9 per cent; pork, 3.9 per cent; poultry, 5.6 per cent; milk, 2.8 per cent; and eggs, 4.8 per cent. Attainment of these rates, however, does require considerable effort.

The problem of increasing cattle production was recognized as being of a complex nature; yet it is forecasted that in 1985 the developing countries will rely on cattle for about half of their meat supplies and for virtually all milk requirements. On the other hand, it is recognized that considerable scope exists for expanding the poultry and pig industries which, in the short and medium term, can contribute far more rapidly to increasing the supply of meat with the advantage, over cattle, of converting grain and other food concentrates into meat much more efficiently. This is of particular importance to those developing countries where conditions make it difficult to grow a sufficient supply of cereals for human consumption. Also, as poultry and pigs can be raised by small-scale farmers, the latter have in this way the opportunity to improve their income and their families' diet.

^{1/} Rome, 5 - 16 November 1974.

^{2/} Provisional Indicative World Plan for Agricultural Development, Vol.1, page 245, Rome, August 1969.

Adequate veterinary services are crucial to an increased livestock development effort. Any livestock development programme has always to contain the three traditional components, namely breeding, feeding and health. The inter-connection between these factors is evident: it would be wasteful of resources to initiate expensive programmes for establishing more productive breeds if there is no serious prospect of properly feeding them. It would be wasteful also to open up large areas of hitherto unused land without parallel investment in disease control. And without disease control it would be wasteful either to elaborate a breeding programme or to plan an expansion of production and export of meat which potential importing countries will not accept (e.g. because of foot and mouth disease).

An example of the potential returns to animal disease control is the case of African trypanosomiasis, a disease borne by the tse-tse fly, which is one of the chief obstacles to the exploitation of the hydro-pastoral resources of tropical Africa. It is estimated that if trypanosomiasis were brought under control this zone could carry a supplementary cattle population of approximately 120 million head. This could produce 1,500,000 tons of meat per year, representing a value of at least US.\$ 750 million, a figure equivalent to, for example, half the national income of a country like Tanzania.

At the level of the individual small farmer in developing countries, the consequences of animal disease often are devastating, as, for example, when the family's draught animal - most valuable working capital and source of animal protein - is destroyed.

Aside from the health of the animal population itself, animal disease in developing countries often is the cause of major problems for the health of human population. There are numerous diseases, some of an infectious nature, that are transmitted from animals to man, by direct contact, by vectors, or through food and water. Among such diseases are tuberculosis, brucellosis (malta or undulant fever), equine encephalitis (transmitted by infected insects) and rabies, a fatal disease once symptoms have developed. Others are caused by parasites such as tapeworms, flukes, hydatid cyst - mainly affecting the lungs and liver and causing long illness, usually requiring severe surgery.

The requirement for veterinary services, therefore, has two main components, corresponding to two sets of veterinary functions:

- (i) preservation and restoration of animal health, particularly livestock and, in some countries, participation in livestock development schemes; and
- (ii) protection of human health from diseases transmitted by animals and their products.

In addition to these functions, a well-established veterinary service would be expected to support:

- (1) dissemination of information related to the above-mentioned functions, and

- (11) research related to the same issues.

The operational orientations of a veterinary service, however, vary to some extent with the level of development of a country. In developed countries, livestock is subject to an intensive exploitation by the use of highly-developed genetic breeds of a high economic unit value which, however, are more susceptible to disease. Optimum yields under such circumstances require complex technology and management, and livestock require intensive care. The emphasis in such cases is on the individual case rather than on mass attention, and the high-quality veterinary services which are required can be provided mainly by graduate veterinarians.

The situation normally is different in less-developed countries where there is a predominance of native livestock with low unit value and yields, and where the management and production methods are simple. Mass prevention and treatment of disease is the priority task in such cases and animal health assistants can play an important role.

As countries move upwards in the ladder of livestock development, the demand for graduate veterinarians increases: mass prevention and treatment of disease are progressively replaced by the "herd" or the "individual" care justified by the higher value of livestock and the complex health problems linked with high productivity. This favours the development of veterinary services in the private sector which, as a rule, co-operates with the public services in the areas of diagnosis and control of communicable diseases. As a result, the field services become more restricted with regard to clients, and are delivered mainly to small livestock farmers owning livestock of a lower unit value. Under these circumstances, animal health assistants can still play an important role.

In the less-developed countries, veterinary services are almost exclusively production-oriented. Services for social and other purposes are slower to develop for the following main reasons :

- (i) Veterinary Public Health Services aiming at preserving human health from animal diseases (e.g. through food inspection, rabies control programmes, etc.) would normally require a certain organizational infrastructure which usually does not exist or develops at a later stage in developing countries.
- (ii) The number of owners of sport, pleasure animals and pets in developing countries that would require veterinary services is virtually non-existent, or relatively small, and would only increase should there be a rise in the standard of living.

Estimating the Needs for Veterinarians

No matter how small a country is, there is always a need for a minimum core of veterinarians for administration of services, animal disease diagnosis, or planning and programming of animal disease control, food inspection, quarantine control, research, regulatory measures, production and/or control of biological products such as vaccine, sera, antigens, etc.

One way to examine the adequacy of veterinary services in a country consists of the conversion of the livestock population into livestock units^{1/} and its comparison with the number of veterinarians available. The second FAO/WHO International Meeting on Veterinary Education (Copenhagen, 12-21 August, 1965) concluded that an effective ratio of one graduate veterinarian to 3,000-5,000 livestock units was typical of most of the more developed countries. The Meeting suggested that in less-developed and developing countries, a target ratio of one veterinarian to 30,000 livestock units would probably meet the minimum requirements. It also indicated that this ratio was already attained in some of the developing countries, and that it might have to be narrowed as livestock development progressed. The Meeting also agreed that the ratio was still much wider than one veterinarian to 30,000 livestock units in some countries, and suggested that this ratio should be attained as soon as conditions would permit, in accordance with future livestock development, and preferably within the next 10-20 years.

The ratios of livestock units to a graduate veterinarian cited above are intended only as rough guides. In many countries it would be necessary to make modifications depending on: the degree to which extensive or intensive animal husbandry is practised; the sizes of the flocks and herds; the distribution and concentration of livestock; the types and extension of communications within the country; the use of animals for agricultural and transport work; the amount of beef and milk production; the economy of livestock production as between internal consumption and export; the total human population and standard of living; the part played by veterinarians in animal husbandry; trends in the development of livestock production; the disease position and the state of disease control programmes; the measure of veterinary work on small animals - dogs, cats, etc., and animals for sport and pleasure; public health, food hygiene and zoonoses. All these and other relevant points should be taken into consideration when determining, in a given country, the desirable composition of the professional and sub-professional veterinary manpower stock.

In order to have a general overview of the situation of veterinary services with regard to the availability of graduate veterinarians, a study is presented in this paper covering 117 countries - 26 in Europe, 39 in Africa, 25 in the American hemisphere, and 27 in Asia and Oceania. Ratios were worked out in these countries on the number of livestock units per veterinarian and the human population per veterinarian (see Annex 1). The former ratio is expected to indicate the situation in the country regarding veterinary services as functions mainly oriented towards production, while the latter would give, in addition, an indication as to the situation with respect to social and other functions.

The results of this study (see Annex 2) show a wide variation between countries in the ratio of livestock units to veterinarian: with extremes of 400 in Japan and 1,162,000 in Haiti. A similar range of variation is observed in the

^{1/} For this conversion see Annex 1.

ratio of human population to veterinarian, with 2,400 in Denmark and 5,000,000 in Haiti. Overall results can be summarized as follows :

- (1) Generally speaking, regions and countries with higher levels of social and economic development are better provided with veterinary services. Countries with veterinary/livestock units and veterinary/human population concurrent ratios up to 1:6,000 and 1:12,000 respectively, include all developed countries in Europe, U.S.A., Canada, Japan, New Zealand and Israel.
- (11) A second group of countries where the concurrent ratios would be between 1:6,000 and 1:30,000 (a minimum ratio for the provision of reasonable veterinary services suggested by the Second FAO/WHO International Meeting on Veterinary Education), and between 1:12,000 and 1:60,000 respectively, includes most of the countries lying in the American hemisphere, some countries in Asia and Oceania and a few African countries.
- (111) A third group of countries where ratios referred to in points (1) and (11) are not met (and which may be called "deficit" countries) includes, from among the countries listed in Annex 2, 20 per cent of those in the American hemisphere, 60 per cent of those in Asia and Oceania, and 80 per cent of those in Africa.

In the "deficit" countries a study should be carried out as to the most appropriate strategy to follow for meeting minimum requirements. In each country a decision should be made as to whether the number of additional veterinarians required would justify the establishment of a Faculty of Veterinary Science, or whether it would be more economic to send students abroad for training in order to secure the number of veterinarians required for these services. In developing countries where the justification for a Faculty is not strong enough, the expansion or the establishment of an animal health assistant training programme may be necessary, nevertheless assistants should be closely supervised by graduate veterinarians. It would be unwise for developing countries in group (111) to attempt to reach veterinary/livestock units ratios similar to those corresponding to the more advanced countries of group (1), as a certain proportion (that could reach 50 per cent) of veterinarians in the latter are devoted entirely to the care of pets and animals for sport and pleasure - a function not applicable in the less developed countries.

The ratio of livestock units to the human population was also calculated. This ratio suggests the possibility of a rough rapid estimate of the position of a given country as far as the availability of food from local livestock sources is concerned. Countries with ratios below 0.3 or above 0.4 may be classified respectively as "deficient" or "surplus" countries. Countries with high figures (net "surplus" countries) are, for example, New Zealand (4.27) and Australia (2.98) in Oceania; Ireland (1.68) and Denmark (1.12) in Europe; Mauritania (2.29), Botswana (1.86) and Swaziland (0.94) in Africa; Uruguay (2.06), Paraguay (1.71) and Argentina (1.27) in the American hemisphere. Low figures are found particularly in Asia - e.g. Japan (0.07) and Korea (0.05). However, attention should be drawn to the fact that low ratios are not necessarily indicative of low animal protein

consumption in the diet as, in certain countries, such protein is supplemented by the consumption of fish. Conversely, there are countries, particularly in Africa, where livestock is kept as a symbol of social status rather than for commercial exploitation.

Estimating the Needs for Animal Health Assistants

Animal health assistants are sub-professionals whose specific function is to assist graduate veterinarians in some of their tasks. It follows, therefore, that any animal health assistant training programme becomes meaningful only in countries where at least a minimum core of graduate veterinarians is available. Animal health assistants are normally entrusted to carry out, under the supervision of a graduate veterinarian, certain field tasks which are directed mainly towards preventive veterinary medicine. Their functions include: vaccinating, blood sampling and testing, collecting suspected tissue and materials, parasite control, quarantine enforcement, regulatory work, assisting in food inspection, disinfecting premises, etc., as well as some minor surgical practices such as dehorning, wound treatment, and castration. In some countries animal development schemes and artificial insemination are also entrusted to animal health assistants.

Requirements for animal health assistants vary widely between countries and therefore no set rules can be applied. In general, such requirements depend on the availability of graduate veterinarians and the stage of livestock development in the country. Information on the available number of veterinarians and on the ratio of livestock units per veterinarian for 117 countries is shown in Annex 2. This Annex could provide a useful warning signal as to the possible need for additional veterinarians in a country and/or animal health assistants, a matter discussed in more detail in the paragraphs below.

Usually no animal health assistants are required in the more developed group (i), countries, but in some cases be required in group (ii) countries. On the other hand, in several of the group (iii) countries where the ratio of 1:30,000 veterinarian/livestock units has not been reached - a large proportion of African, some Asian, and, exceptionally, some countries of the American hemisphere - the expansion of animal health assistant training programmes where these exist, or the establishment of new ones, may be necessary. The Second FAO/WHO International Meeting on Veterinarian Education has suggested that the ratio of animal health assistants to graduate veterinarians in developing countries should not be greater than ten trained animal health assistants to one field graduate, so that effective supervision could be possible. Animal health assistants with a higher level of education will require less intensive supervision than those trained at a lower level. This implies that by raising the intake level and by extending the duration of the course for animal health assistants, one may decrease the number of graduate veterinarians required for supervision and field services.

With regard to the combined force of veterinarians and animal health assistants that may be required for veterinary services, no set rules can be given. A formula has to be worked out specifically for each country, taking into account the prevailing conditions in the country and, perhaps, even in separate regions of the country. Unfortunately, no cross-national reference figures are available for animal

1/ Such requirements are normally for veterinary public health activities.

health assistants. The figures shown in Annex 2 on the ratio of livestock units per veterinarian are valuable, but only as warning signals and should not, a priori, influence conclusions about quantitative needs without an on-the-spot investigation of such elements as:

- (i) updating of figures given in Annex 2, bearing in mind points made in Annex 1 with regard to livestock units per veterinarian;
- (ii) the prospective supply of veterinarians and animal health assistants (if any) in the country, and that of veterinarians trained abroad;
- (iii) the livestock development plan in the country and its implied number of additional professionals and sub-professionals for veterinary services.

An examination along these lines would be the basis for devising a formula concerning the composition of veterinary services with regard to graduate veterinarians and animal health assistants for the target year and, therefore, the additional force that should be trained. However, the feasibility of expanding an existing training programme or of establishing a new one should be carefully examined in the light of the time-span during which the desirable target stock is expected to be met, the financial feasibility of the Government to carry out the programme and to employ its output, and the availability of teaching staff.

THE TRAINING OF ANIMAL HEALTH ASSISTANTS

Administration and Organization of the Course

The Ministry of Agriculture is normally responsible for the organization and administration of training programmes for animal health assistants and usually sets up specific institutions for this purpose under the responsibility of a director appointed by, and responsible to, this Ministry. The Ministry of Agriculture is the obvious choice as the "responsible body" for the programme because, in addition to being by far the most important employer of the trained personnel, it is normally provided with field and laboratory facilities that can be utilized by students for practical work. Furthermore, experienced staff from the Ministry's veterinary services may be made available for teaching. Because the course on the main animal disease problems in the country is practical-oriented, the Ministry of Agriculture, which is directly involved in these issues, is better equipped to handle the programme. As another important function performed by animal health assistants is in the area of human health, the collaboration of the Ministry of Health in the organization of the course and its curriculum would be an asset, as well as any possible contribution of facilities and staff for teaching in areas of particular concern to that Ministry.

In the organization of the course, quality, efficiency and low cost should be the aims. Several strategies may be followed. For example, a special institution may be necessary if justification is provided by the size of the

programme, and by its continuity. However, this should not necessarily mean that the institution would not benefit from whatever physical and human resources may be available at other institutions. Length and content of the programme should be carefully considered. It may be advantageous to have a short formal course followed by carefully supervised on-the-job training (if proper supervision is available), or a sandwich-type course. The content, level, length and type of course should be decided upon only after a final definition of the type and level of functions to be performed by animal health assistants. The curriculum for the course should then be drawn up accordingly:

- (i) general subjects with emphasis on sciences, particularly on biology and chemistry;
- (ii) veterinary science and animal husbandry with emphasis on the former;
- (iii) rural sociology and veterinary extension.

However, if animal health assistants are directly involved in livestock development schemes, this should be reflected in the curriculum by a detailed programme, including farm management and artificial insemination. In Annex 3, an example of curriculum for a two-year post-secondary course is shown. This curriculum should, however, be taken only as an example and not as a rigid guideline.

The area of veterinary science would normally include subjects such as: anatomy, physiology, pharmacology, microbiology, parasitology, pathology, medicine, surgery (minor), food inspection, veterinary public health and a marked emphasis on practical clinical work. Because of the nature of the course and its relatively short duration, the semester, or shorter-term system, is better adapted to arranging an adequate sequence of courses where some are a pre-requisite for others. Practical work, particularly in clinics, should be carried out in small groups.

A minimum core of full-time employed staff will be required for operating the course. All the staff should be of graduate level, and the Ministries of Agriculture and Public Health may contribute to the course with experienced part-time staff for subjects directly related to their functions (e.g. veterinary extension and veterinary public health, respectively). Utilization of facilities belonging to the Ministries would be an additional advantage for the course.

With regard to admission requirements, due credit should be given to students with previous farm experience and/or rural background. The functions of animal health assistants are basically field activities, often in remote rural areas, requiring hard physical work and adaptation to the rural environment and its people. A reasonably incentive salary scale and the establishment of a promotion system are necessary prerequisites for attracting good candidates to the course.

Physical Facilities

When deciding on the location and nature of facilities that will be required for the animal health assistants' course, an assessment should be made of those already available for other ongoing educational and service programmes (science teaching laboratories, veterinary laboratories, animal hospitals, animal husbandry compounds, slaughterhouses) and the possibility of utilizing them should be discussed

with the institutions concerned. This may lead to substantial savings in the construction of buildings and may contribute to making the course more realistic, as some of the facilities in question are the same or similar to those the students will be using after graduation.

The types of educational buildings required for the training programme normally include :

- (i) lecture rooms;
- (ii) science laboratories;
- (iii) laboratories for the teaching of specialized subjects;
- (iv) clinical facilities;
- (v) animal husbandry facilities.

The last category may be secured from other government programmes, and would normally suffice, unless special emphasis to animal husbandry is given in the course. The number of educational units to be constructed would vary with the curriculum, the capacity of the educational programme, and weekly teaching load.

Taking as an example the curriculum given in Annex 3, the number of classrooms and laboratories that would be required has been determined (Annex 5) after calculating the weekly teaching load (Annex 4). It will be noted that two classrooms and four laboratories would be needed, and that each laboratory will be utilized for the teaching of various subjects requiring compatible furniture and equipment. Laboratories are of four different types in this example - excluding a clinical pathology laboratory to be built as part of the clinical buildings. The relatively low utilization factor of laboratories (53 per cent) in this example is due to a relatively low enrolment figure and to the diversified practical work requirements of the course. Examples of areas for various types of accommodation related to this course are given in Annex 6.

It is difficult to give an indication of equipment costs because of the variations derived from the level, size, and curriculum of the course and the facilities that may be obtained from other sources for practical teaching. The cost of equipment for this type of course is normally on the high side.

ANNEX I

THE LIVESTOCK UNIT

The livestock unit expresses a weighted conversion of the various species of livestock into a common denominator or unit. As the purpose of the conversion is to establish a relation between number of animals and amount of veterinary services, the indices applied vary with the degree of veterinary attention required for the various species of livestock. The indices adopted in this paper are those proposed at the Second FAO/WHO International Meeting on Veterinary Education, Copenhagen (1965) and are the following: dairy, cattle, equine and buffaloes - 1.0; beef cattle between 0.1 and 0.5; sheep and goats between 0.1 and 0.01^{1/}; pigs between 0.2 and 0.4^{2/}; and poultry - 0.01. In addition, an index of 0.5 has been applied for camels.

In Annex 2, the highest conversion indices for beef cattle, sheep, goats, and pigs have been applied for developed countries, while for developing countries lower indices have been selected in accordance with their own livestock development level. The information on livestock population refers to the year 1972 and has been obtained from the 1973 FAO-WHO-OIE Animal Health Yearbook. The numbers of dairy cattle for countries for which relevant information is not provided in this Yearbook (marked with * in Annex 2) have been estimated from the total cattle population on the assumption that this proportion is roughly the same as that in other countries of the region with comparable ecological characteristics. The Yearbook also has been the source for the number of veterinarians in the various countries, although some of the figures have been updated from information available at Unesco. Information on the GNP per capita has been taken from the World Bank Atlas (IBRD, 1972).

The ratio livestock units/human population, shown in Annex 2, provides a rough indication of the situation in the countries regarding livestock resources for food production in relation to the human population, a matter of contemporary concern likely to increase in the future. In calculating this ratio, the numbers of animal units representing equine and camels have been subtracted from the total in view of the low significance of this type of livestock in food production.

1/ The last figure is used when large herds of low economic value are the prevailing pattern.

2/ The latter figure is used when the pig industry is highly developed.

ANNEX 2

RATIOS/VETERINARIAN/LIVESTOCK UNITS, VETERINARIAN/HUMAN POPULATION AND LIVESTOCK UNITS/HUMAN POPULATION

EUROPE

	Livestock Number in Thousands									Number of Animal Units (000's)	Number of Vets.	Human Popu- lation (millions)	GNP per Capita 1972 (US.\$ 000's)	Ratios		
	Cattle		Buffaloes	Equine	Camels	Sheep	Goats	Pigs	Poultry					Animal Units to Vets. (000's)	Human Population to Vets. (000's)	Livestock Unit/ Huma. Population
	Dairy	Beef														
Spain*	1,416	2,833		1,110		17,862	2,514	7,177	49,070	9,056	7,375	34	1,020	1.2	4.7	0.23
Bulgaria	644	734	74	491		10,127	318	2,806	34,600	4,085	2,887	8	760	1.4	2.8	0.45
Norway	424	514		28		1,645	77	700	6,000	1,221	849	4	2,860	1.4	4.7	0.30
U.S.S.R.	40,527	61,907	460	7,831	230	139,916	5,417	71,434	682,000	129,843	80,000	247	1,790	1.6	3.1	0.50
Hungary	739	1,161		207		2,271	36	7,353	67,127	5,368	3,325	10	1,600	1.6	3.0	0.52
Italy	4,472	4,139	58	654		7,845	1,000	8,196	110,000	12,381	7,000	54	1,760	1.8	7.7	0.22
Yugoslavia	2,786	2,362	66	1,135		8,326	150	6,216	43,661	8,935	4,624	20	650	1.9	4.3	0.39
Federal Republic of Germany	6,612	7,026		265		850	43	20,000	102,182	19,500	9,818	59	2,930	2.0	6.0	0.33
Switzerland	1,051	789		48		300	68	1,879	6,059	2,342	1,098	6	3,320	2.1	6.0	0.38
Austria	1,175	1,323		43		112	56	3,091	12,534	3,258	1,549	7	2,010	2.1	4.5	0.46
Sweden	1,350	510		53		325	12	2,437	8,031	2,745	1,180	8	4,040	2.3	6.8	0.34
Czechoslovakia	2,082	2,267		118		932	241	5,935	38,201	6,189	2,500	14	2,230	2.5	5.6	0.43
German Democratic Republic*	1,750	3,500		107		1,607	113	9,000	44,110	7,469	2,868	16	2,490	2.6	5.6	0.46
Denmark	1,153	1,497		49		50	5	8,864	17,235	5,673	2,065	5	3,190	2.7	2.4	1.12
U.K.	5,409	8,074		145		26,877	15	8,619	140,045	15,834	5,848	56	2,270	2.7	9.6	0.28
Belgium	1,234	1,606		59		80	3	4,200	44,120	4,225	1,500	9	2,720	2.8	6.0	0.46
Netherlands	1,930	2,270		90		592	20	6,230	59,157	6,299	2,153	13	2,430	2.9	6.0	0.48
Greece	740	240	18	745		8,052	4,120	380	25,425	3,246	1,116	9	1,090	2.9	8.0	0.28
Finland	889	946		60		155	2	1,064	9,864	1,761	603	5	2,390	2.9	8.3	0.34
Poland	6,326	4,924		2,510		3,200	120	16,946	185,300	20,259	6,600	33	1,400	3.0	5.0	0.54
Romania	2,229	3,299	75	662		14,071	563	7,742	61,281	9,787	3,200	20	930	3.0	6.2	0.46
Portugal*	373	747		256		5,700	500	1,420	14,260	2,257	670	9	660	3.4	13.4	0.22
Ireland	1,713	4,728		192		4,276	32	1,198	12,060	5,245	1,211	3	1,360	4.3	2.5	1.68
France	11,184	10,562		581		10,114	909	11,385	190,000	24,599	4,400	51	3,100	5.6	11.6	0.47
Cyprus*	11	22		53		430	368	101	3,809	231	36	0.6	950	6.4	16.6	0.30
Turkey	5,000	7,653	1,062	3,088	29	36,760	19,000	18	34,800	15,315	1,881	37	310	8.1	19.6	0.33

Note: For explanations on countries marked with * and the calculation of livestock units, see Annex 1.

ANNEX 2 (Contd.)

RATIOS/VETERINARIAN/LIVESTOCK UNITS, VETERINARIAN/HUMAN POPULATION AND LIVESTOCK UNITS/HUMAN POPULATION

AFRICA

	Livestock Number in Thousands									Number of Animal Units (000's)	Number of Vets.	Human Popu- lation (millions)	GNP per Capita 1972 (US.\$ 000's)	Ratios		
	Cattle		Buffaloes	Equine	Camels	Sheep	Goats	Pigs	Poultry					Animal Units to Vets. (000's)	Human Population to Vets. (000's)	Livestock Units/ Human Population
	Dairy	Beef														
Egypt*	710	1,420	2,200	1,437	125	2,090	1,350	15	31,450	5,327	2,618	35	210	2.0	13.4	0.11
Libyan Arab Republic*	36	72		97	100	2,300	1,100		1,060	385	65	2	1,770	5.9	30.8	0.12
S. Africa	3,300	10,903		683		34,870	6,540	1,568	24,420	10,030	820	21	760	12.2	25.6	0.44
Liberia*	10	20				160	155	84	1,955	75	6	1	240	13.0	167.0	0.07
Sierra Leone*	87	173				60	160	31	2,312	181	2	10	190	18.0	200.0	0.09
Angola*	934	1,866		5		180	850	340	4,600	1,698	93	6	300	18.0	333.0	0.28
Rhodesia	85	5,615		175		800	1,900	204	9,800	2,236	110	6	280	20.3	54.6	0.34
Tunisia	250	420		344	290	3,100	450	8	11,060	1,153	49	5	250	23.0	102.0	0.13
Mozambique*	716	1,434		19		230	890	260	6,100	1,361	54	8	240	25.0	148.0	0.17
Zaire*	323	647				700	2,000	528	6,900	879	35	17	90	25.1	485.7	0.05
Algeria*	288	575		597	180	8,420	2,200	4	14,061	1,819	70	15	300	26.0	214.3	0.08
Swaziland	250	350		18		42	280	14	365	394	15	0.4	180	26.2	26.6	0.94
Kenya	295	8,905		2	322	3,800	4,000	75	14,000	3,771	142	11	150	26.5	77.5	0.33
Zambia	670	980		1		29	190	110	7,000	1,078	39	4	400	27.6	102.5	0.27
Malawi	335	215				180	640	180	8,000	573	18	4	80	31.8	222.2	0.14
Sudan*	4,900	9,800		670	3,200	4,800	10,150	7	19,000	11,550	314	17	120	36.8	54.1	0.55
Ghana	300	650		29		1,500	1,700	350	12,000	909	23	9	310	39.5	391.3	0.09
Ivory Coast*	147	313		2		893	893	185	6,000	447	11	4	310	40.0	364.0	0.11
Nigeria*	3,801	7,604		1,070	20	2,730	24,000	880	83,600	7,766	189	58	120	41.0	307.0	0.12
Burundi*	227	453				245	420	20	2,300	425	10	3	60	42.5	300.0	0.14
Togo	65	145		3		595	600	228	1,915	258	5	2	140	51.6	400.0	0.13
Botswana	711	1,089		47		402	1,035	15	492	1,164	22	0.6	110	52.9	27.2	1.86
Uganda*	1,534	3,066		16		900	1,970	65	10,500	2,737	49	9	130	55.8	183.7	0.30
Mauritania	1,120	2,650		255	720	3,954	3,070		2,700	2,909	5	1	140	58.2	200.0	2.29
Somalia*	950	1,900		43	3,000	3,900	5,000	7	2,200	2,532	40	3	70	63.3	75.0	0.33
Senegal	1,430	1,370		390	30	1,420	1,600	100	7,500	2,504	35	4	230	71.5	114.2	0.52
Cameroon*	650	1,300		150		1,470	2,000	350	8,500	1,544	19	6	180	81.0	316.0	0.23
Morocco*	1,213	2,427		1,783	233	17,500	8,870	15	15,900	5,372	64	16	230	83.9	250.0	0.21
Dahomey*	230	460		3		640	650	400	3,000	585	7	2	90	84.0	286.0	0.29
Tanzania	5,580	7,820		160		2,820	4,455	23	21,193	8,664	78	14	100	114.0	179.4	0.60
Mali	2,360	2,790		630	215	5,500	5,350	28	12,500	4,608	39	5	70	118.0	128.2	0.82
Lesotho*	187	373		106		1,720	910	68	1,415	570	4	1	90	142.0	250.0	0.46
Central African Republic	225	225		1		68	535	58	1,155	350	2	1	140	175.0	500.0	0.35
Niger*	1,466	2,934		570	350	2,800	6,200	27	7,100	3,620	17	4	90	213.0	235.0	0.72
Upper Volta	1,250	1,350		360	5	1,550	2,700	170	11,000	2,390	11	5	60	217.3	454.5	0.40
Ethiopia	9,903	16,547		6,820	995	12,950	11,370	19	50,000	23,900	82	36	80	291.0	317.3	0.64
Chad*	1,503	3,067		430	370	1,800	2,400	5	3,000	3,280	10	4	80	328.0	400.0	0.67
Rwanda*	250	500				232	600	60	580	450	1	3	60	450.0	3,000.0	0.45
Guinea*	620	1,240		3		500	540	30	4,300	1,099	2	4	120	550.0	1,000.0	0.27

Note: For explanations on countries marked with * and the calculation of livestock, see Annex 1.

ANNEX 2 (Contd.)

RATIOS/VETERINARIAN/LIVESTOCK UNITS, VETERINARIAN/HUMAN POPULATION AND LIVESTOCK UNITS/HUMAN POPULATION

AMERICAN HEMISPHERE

	Livestock Number in Thousands									Number of Animal Units (000's)	Number of Vets.	Human Popu- lation (millions)	GNP per Capita 1972 (US.\$ 000's)	Ratios		
	Cattle		Buffaloes	Equine	Camels	Sheep	Goats	Pigs	Poultry					Animal Units to Vets. (000's)	Human Population to Vets. (000's)	Livestock Units/ Human Population
	Dairy	Beef														
U.S.	49,000	68,862		8,005		18,710	1,500	62,507	434,000	122,800	29,000	209	4,760	4.2	7.2	0.55
Chile	1,400	1,724		451		6,900	850	1,180	17,000	3,000	642	10	720	4.7	15.6	0.25
Ecuador*	857	1,714		557		1,930	192	1,390	5,651	2,506	520	6	290	4.8	11.5	0.32
Trinidad/Tobago*	22	45	7	5		6	38	55	5,550	118	20	1	860	5.9	50.0	0.11
Canada	5,633	7,008		357		719	23	7,246	101,000	13,470	2,250	22	3,700	6.0	9.7	0.60
Mexico*	8,500	17,000		10,620		5,000	8,300	12,300	145,000	30,031	5,000	54	670	6.0	10.8	0.36
Panama	575	721		169			5	147	3,951	1,041	152	1	730	6.8	6.5	0.87
Cuba*	2,433	4,867		816		300	83	1,450	13,500	5,299	687	9	530	7.7	13.1	0.50
Peru*	1,437	2,873		1,427		17,000	1,945	2,070	24,363	5,537	700	14	450	7.9	20.0	0.29
Jamaica	33	237		45		7	360	200	3,531	260	31	2	670	8.4	64.5	0.11
Dominican Republic*	474	949		426		86	760	1,200	7,744	1,665	155	4	350	10.7	25.8	0.31
Guatemala	766	894		190		631	80	941	9,900	1,638	150	5	360	10.9	33.3	0.29
Venezuela	3,600	4,949		1,020		98	1,397	1,691	20,000	6,883	577	11	980	11.9	19.0	0.53
Uruguay*	2,900	5,798		414		15,614	12	470	6,775	6,611	500	3	820	13.2	6.0	2.06
Brazil*	32,500	65,000	140	16,610		24,400	14,500	67,000	312,850	93,853	6,800	98	420	13.8	14.4	0.79
Paraguay*	1,986	3,964		751		330	65	540	6,650	4,175	300	2	260	13.9	6.7	1.71
Costa Rica	583	1,047		117		2	1	190	4,200	1,111	70	2	560	15.9	28.5	0.50
Argentina	19,150	34,850		3,840		42,000	5,250	4,350	35,450	35,576	2,000	25	1,160	17.0	12.5	1.27
Colombia	7,330	15,070		1,600		2,036	660	1,540	33,650	14,379	800	23	340	18.0	28.7	0.56
Bolivia*	767	1,533		1,050		7,000	2,500	1,000	3,645	3,087	160	5	180	19.2	31.2	0.41
Guyana*	84	170		6		90	36	82	8,145	253	13	0.8	370	19.4	61.5	0.31
Nicaragua*	890	1,780		227		2	8	645	3,200	1,878	66	2	430	28.4	30.3	0.83
El Salvador	620	645		86		3	11	429	8,100	1,113	28	3	300	39.7	107.1	0.34
Honduras	640	1,070		441		9	57	730	7,300	1,696	38	3	280	44.6	78.9	0.42
Haiti	242	485		654		73	1,254	1,602	3,334	1,621	1	5	110	1,621.0	5,000.0	0.19

Note: For explanations on countries marked with * and the calculation of livestock units, see Annex 1.

ANNEX 2 (Contd.)

RATIOS/VETERINARIAN/LIVESTOCK UNITS, VETERINARIAN/HUMAN POPULATION AND LIVESTOCK UNITS/HUMAN POPULATION

ASIA AND OCEANIA

	Livestock Number in Thousands									Number of Animal Units (000's)	Number of Vets.	Human Popu- lation (millions)	GNP per Capita 1972 (US.\$ 000's)	Ratios		
	Cattle		Buffaloes	Equine	Camels	Sheep	Goats	Pigs	Poultry					Animal Units to Vets. (000's)	Human Population to Vets. (000's)	Livestock Units/ Human Population
	Dairy	Beef														
Japan	1,992	1,604		104		27	157	7,245	222,661	8,029	21,413	107	1,920	0.4	4.9	0.07
S. Korea	596	654		28		3	286	1,510	24,170	1,527	3,113	33	250	0.5	10.6	0.05
Israel	138	262		13	10	184	133	64	13,439	507	306	3	1,960	1.6	9.8	0.16
Jordan*	14	22		53	9	750	400		2,622	163	45	2	250	3.6	44.4	0.05
New Zealand	4,172	4,827		80		59,900	39	603	5,854	12,897	3	689	2,700	4.6	4.3	4.27
Lebanon*	34	52		30		220	300	14	6,100	170	33	3	590	5.1	90.9	0.05
Kuwait*	3	3		100	6	85	65		906	125	16	0.8	3,760	7.8	50.0	0.03
Thailand*	1,920	2,880	5,800	168		45	30	5,200	51,090	7,928	951	38	200	8.3	39.9	0.20
W. Malaysia	124	202	220			41	340	760	26,000	911	90	9	380	10.1	100.0	0.10
Philippines*	773	1,160	4,711	295		29	1,082	7,742	52,968	6,680	500	40	210	13.4	80.0	0.16
Australia	12,782	14,595	100	459	2	162,393	86	3,198	102,000	39,178	2,800	13	2,820	14.0	4.6	2.98
India	55,100	121,660	54,800	2,020	1,100	43,000	68,500	4,780	117,500	159,207	10,800	563	110	14.7	32.1	0.27
Singapore	6	2	3				2	1,140	12,990	482	29	2	920	16.6	68.9	0.24
Iran*	2,206	3,310	434	2,403	110	36,000	14,700	45	31,205	8,738	500	30	380	17.4	60.0	0.21
Pakistan*	8,068	12,102	12,720	1,335	850	16,720	9,060	90	16,430	21,298	1,080	53	83 ^{1/2}	19.7	49.0	0.37
Sri Lanka	980	670	710	1		24	570	127	8,036	2,063	98	13	110	21.0	132.6	0.16
Iraq	800	1,200	290	768	300	16,000	2,500		4,900	3,247	152	10	320	21.3	65.8	0.23
Saudi Arabia*	132	198		140	570	3,400	2,100		5,200	943	33	8	440	28.5	242.4	0.06
Indonesia*	2,720	4,080	3,000	700		3,500	7,500	4,500	83,500	8,879	300	128	80	29.5	426.6	0.06
Burma	1,870	5,330	1,620	72		180	600	1,600	19,658	5,876	151	29	80	38.9	192.0	0.20
Syrian Arab Republic	305	570	2	365	7	6,500	770		3,788	1,584	33	6	290	48.0	181.8	0.20
Khmer Republic	680	1,420	800	9		2	1	1,100	6,000	2,305	43	7	130	53.6	162.7	0.33
S. Viet Nam	359	538	560	12		13	43	4,071	37,800	2,415	40	18	200	60.3	450.0	0.13
Laos*	174	261	950	29			36	1,200	12,740	1,249	19	3	120	65.7	157.9	0.41
Nepal*	2,560	3,840	3,500			2,220	2,300	300	19,000	5,968	42	11	80	142.0	261.9	0.54
Afghanistan*	1,500	2,250	35	1,585	300	23,000	3,300		18,500	5,428	35	17	80	155.0	485.7	0.22
Yemen Arab Republic*	560	840		3	60	3,751	8,849		2,931	1,505	7	6	80	215.0	857.1	0.24

Note: For explanations on countries marked with * and the calculation of livestock units, see Annex 1.

^{1/} 1973 figures.

ANNEX 3

CURRICULUM

(Two-Year Course Post-Secondary) - Diploma
(11 Weeks per Term - Periods of 50 Minutes) ^{1/}

1st Year

2nd Year

1st Term					2nd Term					3rd Term				
Subject	Weekly Periods			Total Periods	Subject	Weekly Periods			Total Periods	Subject	Weekly Periods			Total Periods
	Lecture	Lab.	Field			Lecture	Lab.	Field			Lecture	Lab.	Field	
English	3	-	-	33	English	3	-	-	33	Physiology	4	4	-	88
Mathematics	4	-	-	44	Mathematics	3	-	-	33	Microbiology	4	4	-	88
Biology	3	3	-	66	Biology	1	2	-	33	Parasitology	3	3	-	66
Chemistry	3	3	-	66	Chemistry	3	6	-	99	Anatomy	3	3	-	66
Physics	2	2	-	44	Anatomy	2	4	-	66	Animal Husbandry	3	-	3	66
Animal Husbandry	1	-	2	33	Animal Husbandry	3	-	4	77					
Total	16	8	2	286	Total	15	12	4	341	Total	17	14	3	374
4th Term					5th Term					6th Term				
Pathology	4	6	-	110	Economics and Farm Management	4	-	-	44	Clinical Pathology Laboratory	1	3	-	44
Pharmacology	2	2	-	44	Veterinary Public Health	2	-	4	66	Veterinary Public Health	2	-	3	55
Medicine and Clinics	4	-	10	154	Medicine and Clinics	5	-	10	165	Medicine and Clinics	4	-	10	154
Animal Industry	2	2	2	66	Animal Industry	2	-	2	44	Surgery (Minor)	2	-	4	66
					Rural Sociology	3	-	-	33	Veterinary Extension and Ethics	1	-	3	44
Total	12	10	12	374	Total	16	-	16	352	Total	10	3	20	363

SUMMARY

1st Term
2nd Term
3rd Term
4th Term
5th Term
6th Term

Total

TOTAL PERIODS

286
341
374
374
352
363

2,090

Note: ^{1/} Field practice will be organized during the period between the 3rd and 4th Term and at the end of the 6th Term (about 2½ months each) sending students outside the Centre to different areas of the country under the supervision of Extension Veterinarians, Livestock Officers, Farm Managers, etc.

ANNEX 4

WEEKLY TEACHING LOAD^{1/}

(Two-Year Course - Two Streams per Grade of 32 Students Each - Total 128 Students)

Subjects	1st Term			2nd Term			3rd Term		
	Lecture	Lab.	Field	Lecture	Lab.	Field	Lecture	Lab.	Field
English	6	-	-	6	-	-	-	-	-
Mathematics	8	-	-	6	-	-	-	-	-
Biology	6	12(I)	-	2	8(I)	-	-	-	-
Chemistry	6	12(II)	-	6	24(II)	-	-	-	-
Physics	4	8(III)	-	-	-	-	-	-	-
Animal Husbandry	2	-	8	6	-	32	6	-	24
Anatomy	-	-	-	4	16(IV)	-	6	12(IV)	-
Physiology	-	-	-	-	-	-	8	16(III)	-
Microbiology	-	-	-	-	-	-	8	16(I)	-
Parasitology	-	-	-	-	-	-	6	12(I)	-
Sub-Total	32	32	8	30	48	32	34	56	24
	4th Term			5th Term			6th Term		
	Lecture	Lab.	Field	Lecture	Lab.	Field	Lecture	Lab.	Field
Pathology	8	24(I, IV)	-	-	-	-	-	-	-
Pharmacology	4	8(III)	-	-	-	-	-	-	-
Medicine/Clinics	8	-	80	10	-	80	8	-	80
Animal Industry	4	8(II)	8	4	-	8	-	-	-
Economics/Farm Management	-	-	-	8	-	-	-	-	-
Veterinary Public Health	-	-	-	4	-	32	4	-	24
Rural Sociology	-	-	-	6	-	-	-	-	-
Clinical Pathology Laboratory	-	-	-	-	-	-	2	12	-
Surgery (Minor)	-	-	-	-	-	-	4	-	32
Veterinary Extension and Ethics	-	-	-	-	-	-	2	-	24
Sub-Total	24	40	88	32	-	120	20	12	160
Grand Total	56	72	96	62	48	152	54	68	184

Note: Roman numerals in parenthesis indicate the type of laboratory.

^{1/} Laboratory courses taken in two groups of 16 students and field practice in four groups of 8 (except for Animal Industry - two groups of 16 students).

ANNEX 5

TOTAL TEACHING LOAD AND REQUIRED TEACHING ACCOMMODATION

(Two-Year Course - Three Terms of 11 Weeks Each - Periods of 50 Minutes - 32 Students per Class, Two Streams per Grade)

	Classrooms			Laboratories		
	1st/4th Terms	2nd/5th Terms	3rd/6th Terms	1st/4th Terms	2nd/5th Terms	3rd/6th Terms
Total Periods per Term Group	56	62	54	72	48	68
Maximum Weekly Periods of Teaching		62			72	
Number of Teaching Units Required		2			4	
Use Factors in % (on 34 Periods per Week)		91%			53% ^{1/}	

- 1/ The low efficiency is justified by the diversity of laboratories required to carry out practical work effectively. In addition, a small clinical pathology laboratory for a group of 8 students should be constructed as part of the clinical building and will be utilized also for serving the ambulatory clinics and hospital.

ANNEX 6

BASIC SPACE STANDARDS AND AREAS OF ACCOMMODATION

Type of Accommodation	Maximum Number of Students	Number of Units	Net Area in Sq. Ft.			Remarks
			Per Place	Per Unit	Total	
<u>Classrooms</u>	32	2	18	576	1,152	
<u>Laboratories</u>						
Type I	16	1	50	800	800	Biology, microbiology, parasitology, pathology (micro)
Type II	16	1	50	800	800	Chemistry, animal industry
Type III	16	1	50	800	800	Physics, physiology, pharmacology
Type IV ^{1/}	16	1			(1,000-1,500)	Anatomy, pathology, (post-mortem)
<u>Clinics</u> ^{1/}					(approx. 3,000)	
<u>Library</u>					1,200	Includes: shelving space for 5,000 books, storage for audio-visual aids, librarian's office and reading area for 35 readers

Note: Areas for other types of accommodation - e.g. administration, boarding,¹ staff housing, ablution, etc. - are not included here and can be found elsewhere.

^{1/} Estimated.